Resource Management

Chronic Wasting Disease: An Issue for Shenandoah?

By Jim Atkinson

Since 2002, Virginia deer hunters and other deer interest groups throughout the state have been alerted to the issues associated with chronic wasting disease or CWD courtesy of the Virginia Department of Game and Inland Fisheries. Increased interest and awareness of CWD in the eastern U.S. resulted from a significant increase in surveillance during 2001 that identified a greater than expected prevalence of the disease within both captive and free-ranging deer in a number of geographically distinct areas. As of November, 2005, CWD has been found in a combination of captive and/or free-ranging white-tailed deer, mule deer, rocky mountain elk, and moose in a total of 13 states and two Canadian provinces. Deer within two eastern states (New York and West Virginia) tested positive for the first time during 2005. The West Virginia case is one of only three states (also including Utah and New Mexico) where CWD is currently documented only from free-ranging or wild deer.

Clinical signs of CWD in deer include changes in behavior and body condition that progressively deteriorate over time.

Healthy white-tailed deer in Shenandoah National Park. SNP photo.

CWD, a fatal neurological disease specific to the North American deer listed above, was first described from a captive mule deer herd in Colorado in 1967. CWD is a form of transmissible spongiform encephalopathy or TSE that also includes the bovine form or BSE that is commonly referred to as mad cow disease. Unlike BSE however, there are currently no known pathways for the transmission of CWD from deer to humans. CWD is progressive, degenerative and ultimately fatal with no known treatment of any kind.

TSEs are characterized by the accumulation of abnormal prion (proteinaceous infectious particle) proteins in neural (brain) and lymphoid tissues (lymph nodes and tonsils) of affected animals. CWD and other TSEs transform normal cellular prions into an abnormal, resistant form that do not naturally break down but rather accumulate principally in the brain and lymphoid tissues. As CWD progresses, the accumulation of abnormal prions results in numerous, microscopic holes within affected brain tissue which ultimately affects the neurological function of the host deer.

Clinical signs of CWD in deer include changes in behavior and body condition that progressively deteriorate over time. Affected deer continue to eat but amounts of food are reduced over time leading to emaciation. Excessive drinking and urination are common signs in the terminal stages of

CWD is both transmissible and infectious, but many of the details of transmission between and among deer remain a mystery.

the disease. Other signs may include uncoordinated walking or other movement, unusual stance, head and ear droop and there may be increased preference and activity near sources of water. Once clinical signs of CWD appear, affected deer may survive for several days to several months depending on the stage of the disease within an individual at the time that it is first discovered.

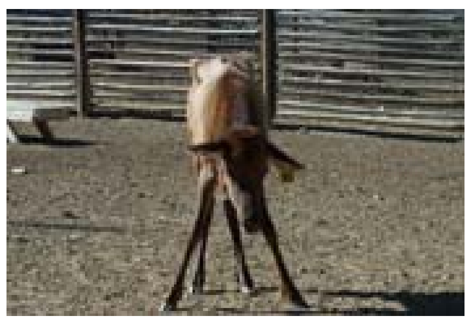
CWD is both transmissible and infectious, but many of the details of transmission between and among deer remain a mystery. The two most suspect transmission pathways based on strong evidence from observations of CWD among captive deer are lateral (animal to animal) and indirect (environmental). The evidence associated with transmission due to CWD contaminated environment is thought to be a function of body secretions (urine, feces and saliva) and from the carcasses of CWD-infected deer. TSE agents (infectious prions) are known to be extremely resistant to environmental degradation. Transmission rates may also be influenced by the presence of high density deer populations which may be the result of either confinement (captive animals) or other untypical aggregation such as attraction to feeders or "yarding" around available food, water and/or specific microhabitats during winter months.

Will CWD become yet another issue for the park? The artificially enhanced and natural rates of CWD spread combined with the success of Virginia's efforts to inhibit those rates will largely define the when or if factor for Shenandoah. The four free-ranging deer that tested positive for CWD near Slanesville, West Virginia in September, 2005 were all within 50 miles of the northern boundary of the park. Virginia rapidly designated portions of Virginia counties within an expanded 10-mile radius of the common state line adjacent to the Slanesville area (generally west of I-81 and north of U.S. Route 50) as a high risk zone for CWD. This zone was expanded to include portions of Virginia counties

The following photos show the progression of the clinical signs of CWD in deer from . . .

early signs of emaciation . . .

to advanced emaciation . . .



and head and ear droop.

adjacent to Maryland (bounded on the east side by U.S. Route 15). Both West Virginia and Maryland are considered at much higher risk for CWD than Virginia due to less stringent regulations associated with the transport and captivity of deer within their jurisdiction.

During the fall of 2005, Virginia randomly sampled and tested brain tissues from approximately 550 hunter killed and road killed deer within the high risk zone. Virginia counties within an expanded 50-mile radius of the Slanesville area were designated as moderate risk zones which include four of the park's eight counties (Warren, Page, Rappahannock and Rockingham). Within the moderate risk zone, Virginia personnel will be conducting surveillance for animals that exhibit clinical signs of CWD but will not be randomly testing dead deer as in the high risk zone. Most remaining areas within Virginia were included in the low risk zone. Dead deer within the low risk zone are currently scheduled for random testing once every five years. Since testing was initiated statewide in 2002, the next scheduled statewide effort will commence in 2007. The designated zones and the testing schedule could change depending on the status of CWD within the state.

Park staff are encouraged to:

- Become educated on CWD and the efforts to identify and inhibit the disease within Virginia.
- Be on the lookout for and report deer exhibiting possible clinical signs of CWD.
- Not attempt to capture or kill suspect deer.
- Have someone monitor a suspect deer, if possible and have the Communications Center contact a park biologist as soon as possible.

There is a specific chain of command that park biologists are to operate within which will become much better defined over time. It is likely that park biologists will initiate opportunistic surveillance within the park this year which involves extracting diagnostic brain tissues for CWD testing from deer found dead along Skyline Drive or illegally harvested within the park. These efforts, albeit of very small sample size, will initiate some baseline information as we all prepare for the next stage, when or if that does occur.

Jim Atkinson is a Wildlife & Fisheries Biologist.

Past and Current Bird Monitoring at Shenandoah National Park

By Rolf Gubler

Introduction

Shenandoah National Park is home to over 200 species of resident and transient birds. Approximately half of these species breed in the park including 18 species of warblers. Due to the park's location along the crest of the Blue Ridge and the extent of forested habitat, Shenandoah provides essential habitat for neotropical migratory birds, both for nesting and as a travel corridor. Certain areas, such as Big Meadows, support species that can be found nowhere else in the park.

Management Needs

During the past 30 years, decline of North American bird populations and their habitats has caused great concern among the bird conservation community. Birds are recognized as critical components of genetic, species, and population diversity. Their status and conservation is a focus of worldwide conservation efforts. Threats to birds in North America are loss of habitat, forest clear-cutting, the draining of wetlands, and development. Because the most significant dangers are habitat-based, large areas of protected refugia like those found in Shenandoah National Park have become increasingly important to neotropical migrants and resident woodland species. Continued monitoring of bird populations is critical in Shenandoah as birds are indicators of the health of our natural ecosystems. In addition to information we are already collecting, more robust information on bird populations such as broad-scale data on productivity and survivorship are needed to provide critical information upon which to initiate research and management actions.

Monitoring Avian Productivity and Survivorship Program (MAPS)

Shenandoah has a long standing history of supporting a variety of bird monitoring programs. These include Breeding Bird Surveys, Annual Christmas Bird Counts in and around the park, and cliff nesting bird surveys. Between 1993 and 2003, the park supported an agreement with the Institute for Bird Populations to conduct the Monitoring Avian Productivity and Survivorship (MAPS) program. The program was discontinued in 2004 due to lack of base funding. The main objective of the MAPS program was to provide standardized population and demographic data for birds found at Shenandoah. From 1993-2003, six MAPS stations were operated within the park. MAPS uses constant-effort mist-netting/banding between late May and August to monitor landbirds. The purpose of Shenandoah's MAPS program was to provide annual indices of adult population size and productivity, as well as estimates of adult survivorship and recruitment into the adult population, for various bird species.

What We Have Learned from MAPS

The MAPS program yielded an average of 500-700 birds banded yearly at the six stations from 1993-2003. Adult population sizes tended to be higher at higher elevation stations and those dominated by northern red oak than at stations dominated by chestnut oak or at lower elevation stations. Stations dominated by northern red oak tended to show higher productivity indices than other stations. The overall trend in bird populations from 1993-2003 was stable. However, a closer look at the data indicate that the stable overall population trend actually reflects a slight decrease after a substantial increase early in the study as species rebounded from the effects of widespread gypsy moth defoliation. The slight decreases in population size between 2002 and 2003 for all stations combined may have been significantly negative were it not for a large increase in population size seen at the Pinnacle Cliff station (which was burned over during the 2000 Pinnacles Fire). This pattern indicates a general decline in population size index during the greater part of the study for most species.

Productivity trends showed 11-year declining tendencies in 12 of 17 species. This pattern indicates a general decline in productivity at Shenandoah during the greater part of the study. At Pinnacle Cliff, where the Pinnacles Fire of November 2000 reduced the cover of mountain laurel, both bird population sizes and productivity decreased disproportionately between 2000 and 2001 (as compared with other stations). In 2002, breeding populations of all species again declined to a greater degree at Pinnacle Cliff than at any other station, as opposed to productivity that increased by a greater degree at Pinnacle Cliff than at any other station. In 2003, breeding population sizes, number of young captured, and productivity all showed substantially larger increases at Pinnacle Cliff, indicating that the bird community rebounded at this station. Bird populations and productivity at Pinnacle Cliff may eventually surpass pre-fire levels. This would indicate the long-term benefits of occasional wildland fire to breeding bird populations. Research has shown that natural disturbances (fire, hurricanes, gypsy moth, ice storms) in even-aged deciduous forests create more diverse forest structure and help boost landbird species associated with forest openings, dense shrubby understories, and ground-nesting (e.g. northern flicker, eastern wood pewee, wood thrush, veery, Canada warbler, black and white warbler, worm-eating warbler). Many of these aforementioned species have responded positively at Pinnacles Station with the increased canopy openings and understory development.

Peregrine Update

Spring cliff nesting bird surveys in March 2005 documented re-colonization by state-threatened peregrine falcons at Stony Man cliffs. The female of the pair was a one-year old unbanded bird. The male was a banded bird at least two years old. A captured partial image of the male's leg band number suggests that this bird is from the 2003 Hawksbill Release. The pair began courtship in mid-March and remained at the nest site and exhibited active nest defense throughout April, May, June, and July. This pair represents only the second successful peregrine breeding in the mountains of Virginia since the DDT era (the first was from 1994-1998 at Stony Man cliffs on a nest 60 feet away from the current nest). In mid-May, the pair produced one young (a female). This bird was photographed on June 29 (see photo). Based on plumage observations, nest fledging is believed to have occurred in late June 2005. Both adults and young dispersed from the Stony Man area by mid-August. This pair's successful breeding represents a fairly uncommon case of a one-year old female falcon successfully producing young.

At present, the long-term viability of the Virginia peregrine population in the absence of continued immigration remains questionable. This is especially true in the mountains of Virginia. Ongoing spring cliff monitoring will help us better document/protect new nesting pairs, and ultimately aid in the monitoring of their long-term recovery. Continued hacking, nest area closures, and overall management are needed to ensure the recovery of this state-threatened species.

Bird Diversity in Hemlock Stands

Neotropical migratory bird point counts in areas of historic hemlock stands (Camp Hoover and Limberlost) were conducted between 1993 and 1995. These point counts were re-started in 2005 in an effort to examine bird species composition changes in these former unique hemlock stands. Preliminary data show that at least one hemlock forest-associated species was not present in 2005 (blackburnian warbler). However, due to the loss of mature hemlock and now open canopies at Limberlost, more "generalist" species were present in 2005 than were present in 1993-1995 (e.g. American robins, American goldfinches).

> In addition to peregrine nesting information, yearly spring cliff surveys have verified the presence of at least four to five active raven nests throughout the park. Ravens are a species that has recovered well in Virginia over the last 30 years, but remains an elusive nester.

Future Work

Staff should continue to refine bird monitoring efforts in response to forest change and information gaps. All information should be evaluated and used for future planning and management decisions. Restarting the MAPS program at Shenandoah would greatly aid with management efforts aimed at protecting the park's avifauna and ecological integrity. Currently, the park is looking to establish a partnership with a local university that would re-implement the Monitoring Avian Productivity and Survivorship Program.

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Shenandoah National Park Nonnative Plant Surveys 1997-2004

By Jake Hughes

As you may recall from previous editions of the *Resource Management Newsletter*, surveys of nonnative plants have been completed in three zones of potential habitat in Shenandoah National Park: along park roads (1997 to 2000), along the park boundary (2003), and in former homesites (2004). The objectives of these projects were to determine the nonnative species present, to quantify the extent of invasion and dominance of the major species present, to identify their general geographical distribution, and to characterize the environmental conditions favoring invasion by nonnatives in Shenandoah National Park. In 2005, the data from these surveys were analyzed and a summary report (Hughes and Åkerson, 2005) was produced. The information resulting from these surveys will provide baseline data for nonnative plant monitoring in the park, and be used to guide management efforts.

Methods

Full descriptions of the sites and the sampling design employed for the park roads, boundary, and homesites surveys can be found in Åkerson (2001), Arsenault et al (2003) and Åkerson (2005), respectively. For a summary of the statistical analyses performed, see Hughes and Åkerson (2005). In all three surveys, data were collected from circular 100m² plots placed at 50m intervals along a 300m transect originating at the road edge, boundary or homesite center. Estimates of percent cover of each nonnative species encountered, as well as for all nonnatives combined, were made in each of three layers: forb (<1m tall), shrub (1-5m) and tree (>5m). Nonnative tree species were also counted and classified based on diameter at breast height (dbh), as follows: class 1 (<7.5cm dbh), class 2 (7.5 – 15cm dbh) and class 3 (>15cm dbh). A 1m² subplot was established within each 100m² plot, in which the number of stems and percent cover of each nonnative species was recorded. In addition, the total canopy cover was recorded, along with slope position, forest cover type, ground aspect, and percent slope.

Significant Findings

As would be expected in edge and disturbed habitats such as the park boundary, roadsides and abandoned developments, nonnative plants were found in abundance. Eighty-two percent (105 of 128) of transects in the roadside survey, 70% (177 of 254) of the boundary transects and 74% (51 of 69) of the homesites contained nonnative plants. The mean number of plots infested with non-natives decreased from the transect point of origin in all three surveys, suggesting that these areas are favorable locations for the establish-ment of nonnative plants.

Forb Layer

Though nonnatives were found in the forb, shrub, and tree layers, nonnative forbs were found to occupy the greatest number of transects and to have penetrated the farthest distance from the transect origin. Nonnative plants were found in the forb layer in over half of transects in each of the three surveys (Figure 1). Nonnative forbs were found an average of 142m from the point of transect origin in the roads survey, and 49m and 99m into the forest in the boundary and homesites surveys, respectively (Figure 2, page 6).

In all three surveys, garlic mustard (*Alliaria petiolata*) was the species most frequently encountered (Figure 1). This species was also found the farthest distance from the transect point of origin in all three surveys (Figure 2). Garlic mustard is known to negatively impact forest ecosystems by displacing native plants (see Hughes and Åkerson (2005) for references on the ecology and impacts of this and the other species mentioned below). Though not found as frequently, Japanese stiltgrass (*Microstegium vimineum*) and Oriental ladysthumb (*Polygonum caespitosum*) were still fairly common in transects and are of particular concern because of the relatively high percent cover they exhibited in infested plots (homesites survey averages of 38 and 27%, respectively), implying that these

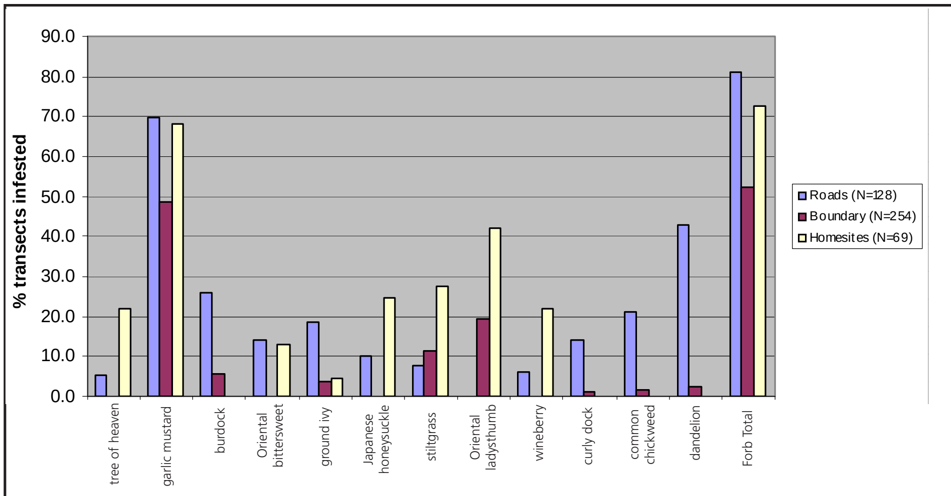

Figure 1. Nonnative plants found with at least 10% frequency in the forb layer of two or more surveys. Note: woody species were not recorded in the forb layer during the boundary survey; the zero values for tree of heaven, Oriental bittersweet, Japanese honeysuckle, and wineberry, therefore, do not necessarily indicate absence from this stratum.

species may have strong effects on native communities. A growing body of evidence exists to indicate that Japanese stiltgrass is harmful, displacing native species and impacting ecosystem properties such as soil pH. By contrast, although Oriental ladysthumb is considered a moderately invasive species by some authorities, no published information exists on the effects of this species in natural systems (a not-uncommon situation for nonnative plants).

Shrub Layer

Nonnatives in the shrub layer were also common, though far less so than forbs. Twenty nine percent of transects in the roads survey were found to contain nonnative plants in the shrub layer, while 37% and 59% were found infested in the boundary and homesites surveys, respectively (Figure 3). The shrub layer of the three survey locales was found invaded by a number of widespread nonnatives well known to resource managers in the east, including the shrubs multiflora rose (*Rosa multiflora*), and wineberry (*Rubus phoenicolasius*), and the woody vines Japanese honeysuckle (*Lonicera japonica*) and Oriental bittersweet (*Celastrus orbiculatus*). Multiflora rose and wineberry are thorny shrubs that can form dense thickets in open forests and along edges, and, because both are bird dispersed, can be easily spread to canopy openings within forests. Oriental bittersweet thrives in the same situations, where it can smother low growing plants and even impact large trees, making them more susceptible to wind and ice damage. The negative impacts of Japanese honeysuckle on forest herbs, shrubs, and tree regeneration have been well documented. Of these species, none stood out as being consistently more abundant or dominant than the others. All occasionally attained cover values in infested plots of over 50%, with Oriental bittersweet exhibiting 100% cover in one homesite's plot.

Nonnatives in the shrub layer were found an average of 40 to 49m from the transect point of origin in the three surveys (Figure 4). Within plots, Oriental bittersweet, tree of heaven, and multiflora rose were among the

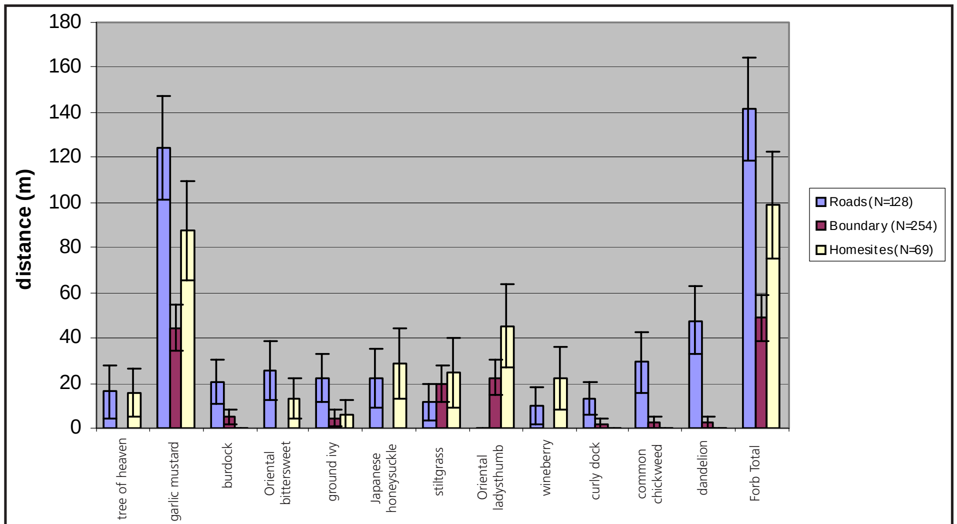

Figure 2. Distance of the final plot along transects containing nonnatives from the transect origin: forb layer. Error bars are 95% confidence intervals of the mean. Note: woody species in the forb layer were not considered during the boundary survey; the zero values for tree of heaven, Oriental bittersweet, Japanese honeysuckle and wineberry, therefore, do not necessarily indicate absence from this stratum.

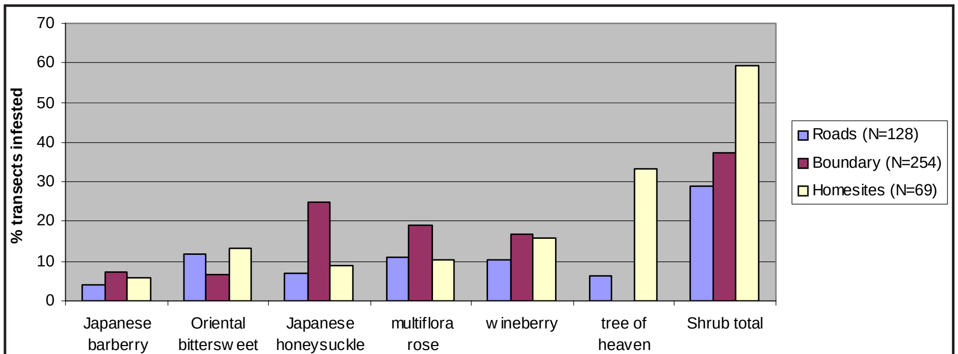

Figure 3. Nonnative plants found at ≥ 5% frequency in the shrub layer in transects. Note: tree species were not recorded in the shrub layer during the boundary survey; the zero values for tree of heaven, therefore, do not necessarily indicate absence from this stratum.

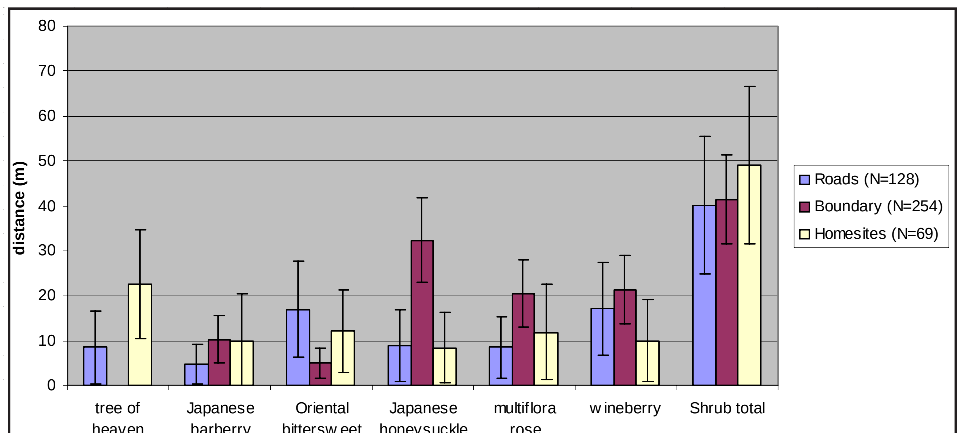

Figure 4. Distance of the final plot along transects containing nonnatives from the transect origin: shrub layer. Error bars are 95% confidence intervals of the mean. Note: tree species were not recorded in the shrub layer during the boundary survey; the zero values for tree of heaven, therefore, do not necessarily indicate absence from this stratum.

nonnative species having the highest percent cover in the shrub layer.

Tree Layer

Nonnatives were found in the tree layer in 11% of transects in the roads survey, 23% of transects in the boundary survey and at 30% of the homesites surveyed (Figure 5). A number of nonnative trees were found in the layer above 5m, including small numbers of invasive nonnatives well known to eastern resource managers (Norway maple (*Acer platanoides*), princesstree (*Paulownia tomentosa*)) and, in the homesites survey, culti-vated species that are likely persistent from plantings (pear (*Pyrus communis*), apple (*Pyrus malus*)). Tree of heaven (*Ailanthus altissima*) was, by far, the most common species

Tree of heaven (*Ailanthus altissima*). Photo by Chuck Bargeron, University of Georgia. www.invasive.org

encountered, and was the only non-native recorded from the tree layer in the roads survey. This species was also found the farthest from the transect point of origin, found an average of 22m into the forest in the boundary survey. Tree of heaven was also found in a relatively large number of plots in the forb and shrub layers, indicating continued successful recruitment of this species in the park. Tree of heaven is known to be an aggressive invader of edge and disturbances in forests, including natural canopy openings, where it can inhibit the growth of native species.

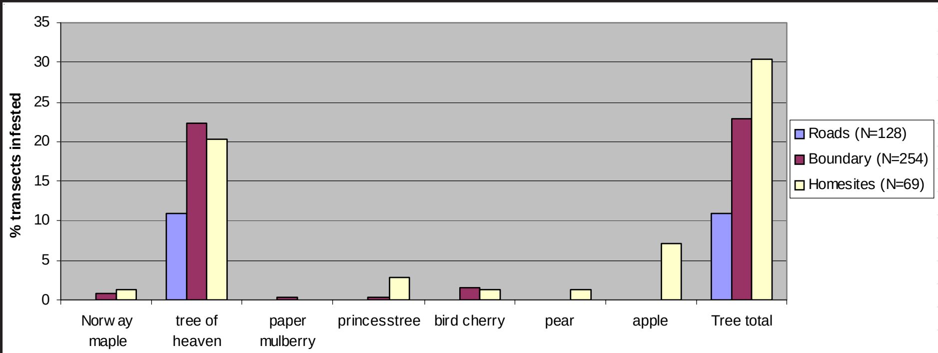

Figure 5. Nonnative species found in the tree layer in transects.

Other Notable Species

Several species were found in only one or a few transects but may warrant extra attention because of their reputation as being invasive in natural areas elsewhere in the eastern U.S. and/or because of high values for percent cover (i.e. high dominance) in infested plots. Mile-a-minute (*Polygonum perfoliatum*) is a highly invasive nonnative that is relatively new to the park, having been documented for the first time in Shenandoah only within the last decade. It aggressively invades edges, forest openings and other high light environments, where it blankets other vegetation with dense mats of foliage. It is reportedly spread by birds that consume its conspicuous blue fruit. Though only found in one transect, it is known from several locations within Shenandoah and is widespread in areas just to the east of the park. Japanese knotweed (*Polygonum cuspidatum*) is a hard to control invader of open streambanks and forest edges. Though not typically an invader of mature forests, the tendency of this species to completely dominate invaded sites, along with the difficulty in controlling it, suggest that attention be given to invaded sites and any new discoveries of this species. Kudzu (*Pueraria montana*) is a well known invader of open areas in the southeast that can completely dominate invaded sites. Privets (*Ligustrum* spp.) are shrubs known to invade forest understories throughout the eastern states. Birds presumably spread their seed. Two tree species mentioned above are also potential threats. Norway maple is a shade tolerant tree that has the ability to dominate forest canopies and negatively impact understory species. Princesstree is an invader of primarily disturbed sites, including natural disturbances along waterways and areas subjected to fire. It is also a potential invader of sparsely vegetated areas such as rock outcrops and shale barrens.

Geographical Patterns

Transects containing nonnatives were found in all three park districts. In general, a higher proportion of transects containing nonnatives was found in the north district, though statistically significant differences were found for only a few species (garlic mustard, Japanese stiltgrass), and differences were not found in each survey. An exception to this pattern was found during the roads survey, where there appeared to be more infestation in the shrub (Oriental bittersweet, wineberry, Shrub total) and tree layers (tree of heaven) in the south district. Clearly,

Mile-a-minute (*Polygonum perfoliatum*). Photo by Britt Slattery, USFWS. www.invasive.org

however, all sections of Shenandoah surveyed contain a diverse assemblage of nonnative plants.

Influence of Site Variables

The influence of the site factors examined was not as strong as expected (see Hughes and Åkerson (2005) for a discussion of difficulties involved in analyzing and interpreting these data). No statistically significant influence of forest cover type was found on the presence of infested transects. The few patterns seen were, for the most part, not surprising. A handful of species (Japanese stiltgrass, Japanese honeysuckle) showed a tendency to be found more frequently on north- and east-facing slopes than elsewhere. There was a tendency for more nonnatives in the shrub layer (particularly Japanese honeysuckle) to be found in sites at or near the bottom of slopes than in more elevated locations. Sites containing Oriental ladysthumb, Japanese honeysuckle and tree of heaven were, on average, less steep than locations free of these species. These patterns may be attributable to moisture and nutrient levels being influenced by aspect, slope position, and steepness.

Applications to Exotic Plant Management

These surveys provide information that will be useful in planning nonnative plant management efforts in Shenandoah National Park. These data suggest that infestations of certain species (e.g. garlic mustard) are likely too large and/or numerous to attempt eradication. Management of these species, if attempted at all, should be directed toward infestations threatening rare plant populations or other significant natural features, or toward new, isolated infestations. Particular attention should be paid to high quality uninfested areas most likely to be invaded (e.g. low elevation areas). Certain other species, notably mile-a-minute and kudzu, represent a threat and may still be rare enough within Shenandoah that eradication can be attempted. These surveys also provide reasonably strong evidence to support the claim that edges such as found along the park's roads and boundary, and areas of human disturbance such as abandoned homesites, function as 'hotspots' of nonnatives, areas of heavy (and probably initial) infestation. Though these areas likely harbor source populations of many nonnatives for other areas of the park and should be targeted for control, these zones should probably not be given first priority for management. Nonnative plant propagules are likely continuously introduced into these areas, particularly the edge sites, by wildlife, wind, and human activity. A management strategy of working from the least infested toward the 'weediest' areas is recommended as the approach that most effectively limits the spread of nonnatives and minimizes the chance of reinfestation and/or invasion by new ones (Cronk and Fuller 1995, Moody and Mack 1988).

The surveys summarized here can provide a suitable baseline for future nonnative plant monitoring in Shenandoah. Repeated measurements from these transects over time could provide valuable information on rates of spread of nonnatives in the areas sampled and, to a lesser extent, identify new invasions. Effects on native plant populations and communities can only be inferred, however, from estimates of percent cover and the literature. Including native species in the data collection effort could help shed light on which nonnative species are having the greatest negative impacts on native species.

Extending these surveys to include tree fall canopy gaps or other areas of natural disturbance may also be worthwhile. Many native herbs, including many rare species, are dependent on natural disturbance such as fire. The regeneration of many forest trees (e.g. many oaks (*Quercus* spp.)) requires canopy openings to release suppressed seedlings. Determining which, if any, of the nonnative species found along edges and in areas subjected to human-mediated disturbance are establishing in areas of natural disturbance could further illuminate those invasive nonnatives that have the greatest potential to impact the natural resources of Shenandoah National Park.

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Forest Monitoring Program Completes Field Revisions - 160 Sites Installed and Sampled

By Nick Fisichelli

The 2005 field season marked the first year of the Natural Resources Branch rotating monitoring schedule. Within the new rotation, major natural resources monitoring programs are active on alternate years. This measure was enacted to save money by decreasing the amount of natural resource monitoring performed in each year. The crews have also been restructured to maintain data continuity. The active program has a 30% larger crew while the inactive program has no crew. The vegetation monitoring program was active in 2005, whereas the aquatic and fisheries monitoring program will be active in 2006.

Vegetation monitoring in 2005 focused on completing the installation and sampling of long-term forest monitoring plots. This work began in 2003 in response to a statistical power analysis and protocol revisions designed to strengthen and streamline the program. The remaining 103 sites were established and sampled in 2005, and the program now contains a total of 160 24m X 24m monitoring sites distributed throughout the park.

The larger crew size and three lead technicians allowed for two to three separate crews to sample simultaneously in the field each day. Crew leaders Nick Fisichelli, David Demarest, and Jake Hughes guided teams of volunteers and technicians during the process of plot installation and data collection throughout the field season. The experience level of technicians, positive crew dynamics, and cooperative weather aided in the efficient completion of field work. The large quantity of data collected in 2005 was entered into a computer database.

The next step in the process will be to analyze the data and identify changes in species composition over time and other trends in the park's

NPS biological science technician Rosa Palarino (left) and SCA volunteer Meridith Gereghty collect data at a forest plot near Pass Mountain.

forest ecosystems. Findings from a preliminary look at the parkwide data include high numbers of black birch (*Betula lenta*) and red maple (*Acer rubrum*) seedlings and saplings. Oaks, while still heavily dominant in the overstory, are showing poor recruitment in the seedling and sapling layers. The birches and maples are prolific seeders and are able to quickly colonize the gaps in the canopy caused primarily by oak and hemlock mortality. Data from 2005, in conjunction with earlier data, show a marked stability in the composition of tulip poplar forests over time. Nonnative plant species were found at most of the 160 sites. The most common nonnative, garlic mustard (*Alliaria petiolata*), was established at 42% of the plots. The next two most common nonnatives, Asiatic water pepper (*Polygonum caespitosum*) and tree of heaven (*Ailanthus altissima*) were found at 39% and 20% of the plots, respectively. A more in-depth study of the data and continued forest sampling will shed more light on these and other phenomena.

The 2006 field season will be devoted to fisheries monitoring. During this time, the vegetation monitoring program lead by the park botanist will continue to address rare plant issues. Forest vegetation monitoring is set to resume in 2007 when all 160 monitoring sites will be revisited to document changes in forest structure and composition.

Nick Fisichelli is a Biological Science Technician.

New Rare Plant Monitoring Timeline Implemented in 2005

By Nick Fisichelli

Shenandoah National Park is home to numerous state and globally listed rare plant species. The high elevation summits, meadows, swamps, and undisturbed forest ecosystems of the park provide the unique habitat required for these plants. The rare plant monitoring program has implemented a new monitoring structure to respond to the rotation of field work between vegetation and aquatic/fish work. It is planned that a portion of the rare plant populations will be visited each year. The species have been ranked as high, medium, and low priority. Priority levels were assigned based on the state/global rare plant rating system, number of populations in the park, and proximity to developed or heavily used areas such as high elevation mountain summits. There are 13 populations of high priority species, 74 populations of medium priority species, and 62 populations of low priority species. The high priority species will be visited annually, the medium priority will be visited on a two-year cycle, and the low priority will be visited every four years.

A total of 21 rare plant species, making up 38 separate populations, were monitored during 2005. Ten high priority rare plant populations including bearberry (*Arctostaphylos uva-urs*i), variable sedge (*Carex polymorpha)*, buckbean (*Menyanthes trifoliata)*, and swordleaf phlox (*Phlox buckleyi)* were assessed. A new population of the swordleaf phlox was discovered and documented and a second population of the phlox, not seen in several years, reappeared during early summer. The number of phlox stems sampled over the past 10 years at Population 1 is illustrated in Figure 1. The population has shown an increase in the number of individuals during the past decade. The drop in numbers in 2005 may be in response to dense woody plant regeneration or due to a change in personnel sampling the area. The elusive small whorled pogonia (*Isotria medeoloides*), discovered in 1997, was not found during this year's search.

Several species on the two-year monitoring cycle were also visited in 2005. Paper birch (*Betula papyrifera*) sites in the north and south districts of the park were monitored in the summer and fall. Populations of speckled alder (*Alnus incana ssp. rugosa*), large purple-fringed orchid (*Platanthera grandiflora*), and linear-leaved willow-herb (*Epilobium leptophyllum*) were also monitored and found healthy. Round-leaved dogwood (*Cornus rugosa*) populations identified in 1993 appear to have died off after several searches in recent years revealed no evidence of their existence. Searches for new populations and monitoring of 65 existing rare plant populations will continue in 2006 by the park botanist and a part-time field technician.

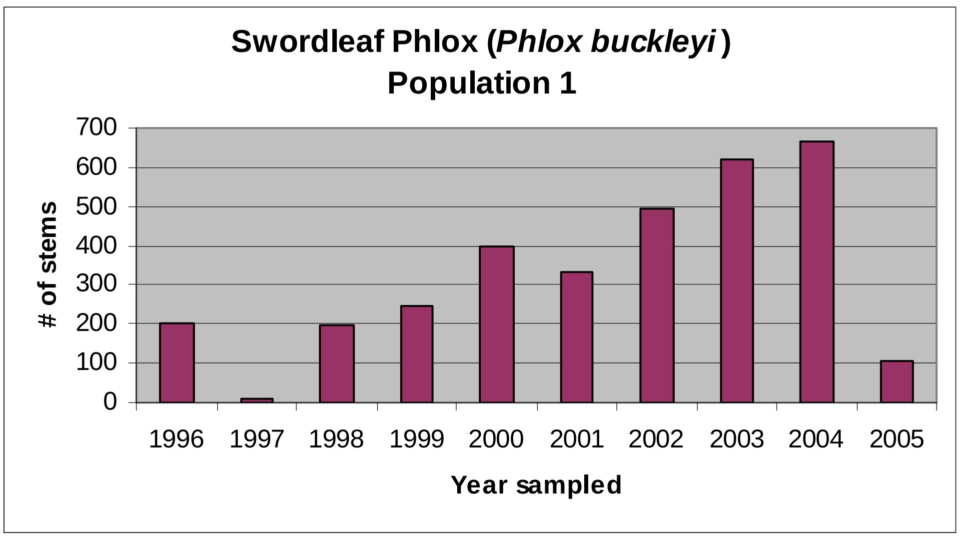


Figure 1. Ten-year trend in swordleaf phlox numbers.

Nick Fisichelli is a Biological Science Technician.

Big Meadows Management and Monitoring - Vegetation Trends 1998-2004

By Wendy Cass

Vegetation management at Big Meadows continued in 2005 with the implementation of mowing and burning treatments. For the purposes of management, the meadow has been divided into three approximately equal sections termed the east, central, and west management sections (Figure 1). Meadow management in 2005 included a spring burn of the western section and entire meadow perimeter, winter mowing of the central section, and no disturbance to the eastern section. Meadow management in 2006 will include winter mowing the western section, no disturbance to the central section, and a burn of the eastern section and entire meadow perimeter. Mowing activities are performed by the park's maintenance division, while prescribed burns are planned and overseen by the park's fire management office.

Trends in vegetation cover from 1998/99 through 2004 show the current management actions in Big Meadows are succeeding at maintaining decreased shrub and increased herb cover throughout the meadow (Figures 2, 3 and 4 on page 12). Decreased shrub cover has been the most difficult to maintain in the upland section of the meadow because of vigorous black locust (*Robinia pseudoacacia*) sprouting. Hand cutting of locust sprouts is currently being pursued by fire management and natural resources staff, with assistance from school groups and volunteers, as time allows.

In an effort to conserve funds, vegetation monitoring at the meadow is currently being done bi-annually as part of a four-year rotation. Within the new sampling scheme, one half of the randomly placed transects within the meadow will be sampled every two years. Data were collected at half of the transects in 2005. The remaining transects will be sampled in 2007. This sampling scheme will generate general information on vegetation changes every two years, and more comprehensive information on vegetation changes every four years.

Wendy Cass is a Botanist.

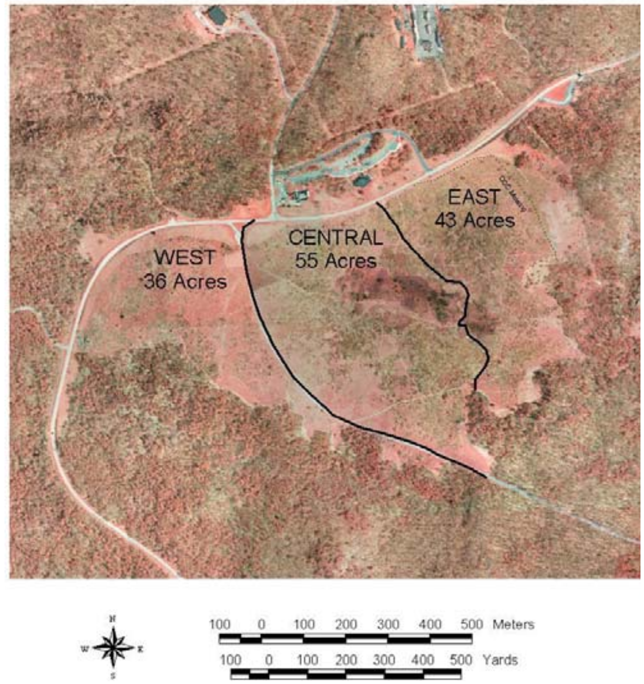


Figure 1. Big Meadows proposed management zones.

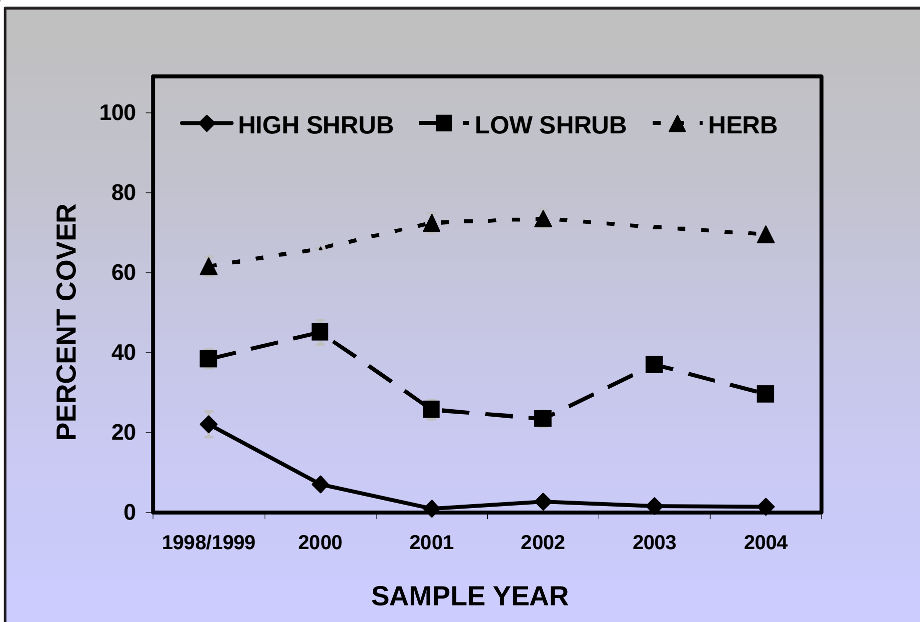


Figure 2. Graph of high shrub, low shrub, and herbaceous (herb) vegetation percent cover in the upland section of Big Meadows over six sample periods. All sample periods cover one year except for the initial sample period which spans 1998 and 1999. Values represent the mean cover ± the standard error of the mean. Herbaceous cover was not sampled in 2000 or 2003.

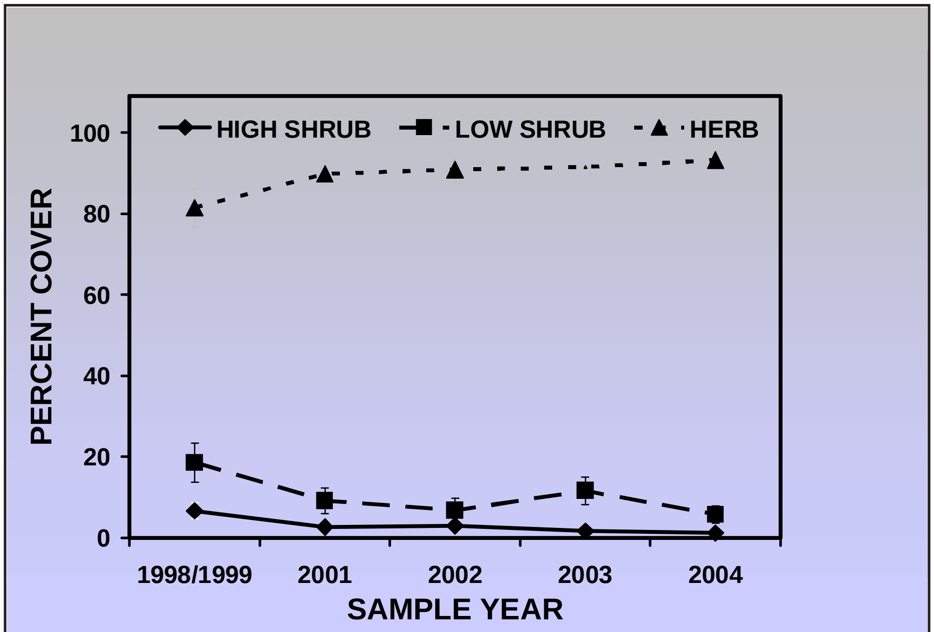


Figure 3. Graph of high shrub, low shrub, and herbaceous (herb) vegetation percent cover in the western section of Big Meadows over five sample periods. All sample periods cover one year except for the initial sample period which spans 1998 and 1999. Values represent the mean cover ± the standard error of the mean. No data were collected in 2000 because this section of the meadow was omitted from management actions. Herbaceous cover was not sampled in 2003.

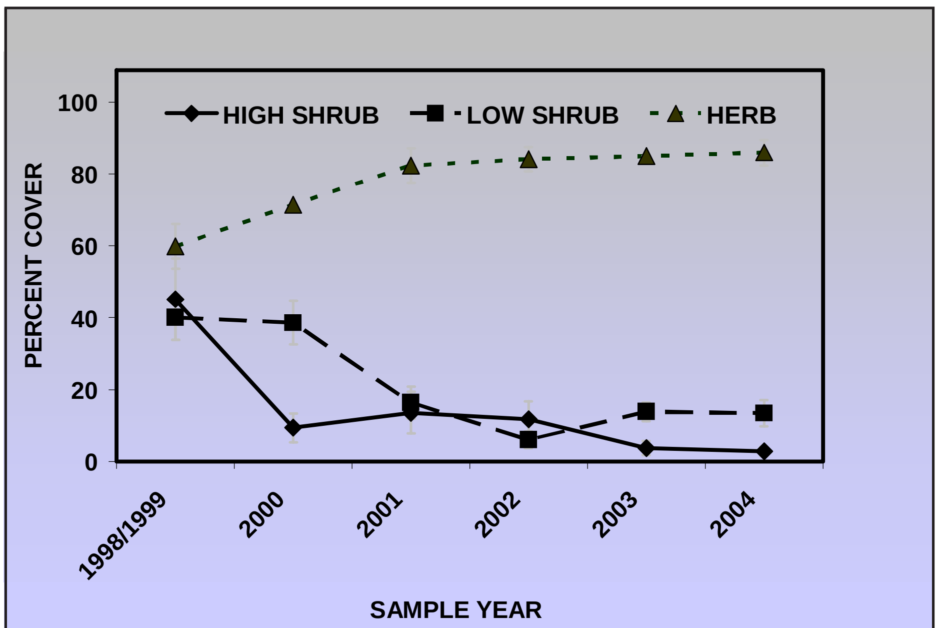


Figure 4. Graph of high shrub, low shrub, and herbaceous (herb) vegetation percent cover in the wetland section of Big Meadows over six sample periods. All sample periods cover one year except for the initial sample period which spans 1998 and 1999. Values represent the mean cover ± the standard error of the mean. Herbaceous cover was not sampled in 2000 or 2003.

Wendy Cass is a Botanist.

Cliff and Rock Outcrop Management Project Underway and On Schedule

By Wendy Cass

After many years of planning and preparation, the Cliff and Rock Outcrop Management Project (ROMP) is underway. The three-year project is funded by a competitive grant from the NPS Natural Resources Preservation Program(NRPP), and is being done to assess the location of rock outcrop and cliff communities throughout the park, to document the abundance and composition of cliff natural resources, and to improve our understanding of visitor use patterns and impacts. The project will culminate in the creation and implementation of a Cliff and Rock Outcrop Management Plan for the park that will detail ways to protect natural resources while still providing for visitor use and enjoyment of cliff and rock outcrop areas.

The summer of 2005 was the first of two field seasons devoted to gathering information on the location, composition and condition of biotic and geologic resources, and recreation uses of cliff resources throughout the park. Rock outcrops throughout Shenandoah were mapped by John Young at the U.S. Geological Survey (USGS), Leetown Science Center using remote sensing, aerial image interpretation, and geographic infor-

mation system modeling. Forty-eight rock outcrop area study sites were then chosen for inclusion in the project. Sites range from extremely popular areas like the summit of Old Rag and Hawksbill mountains, to much less traveled areas such as Halfmile Cliff and Sawlog Ridge.

Staff from the Virginia Department of Conservation and Recreation, lead by ecologists Allen Belden and Kevin Heffernan, are on schedule and have completed approximately half of the planned botanical, zoological, and ecological inventory work. Thus far, they report discovering 26 new rare plant occurrences, nine new vegetation community occurrences, and a rare moth. Additional rare invertebrate occurrences are anticipated as specimens are processed and identified.

The project's geology contractor, Eric Butler, completed detailed geologic site reports for 24 sites. These reports include photographs, maps, and explain physical, geologic, and geomorphic characteristics of each site. Cooperators from Virginia Tech, lead by Jeff Marion and Steve Lawson, successfully developed and administered a visitor use survey at three high-use rock outcrop sites, and sampled visitor recreational use and impacts at 17 rock outcrop sites. Preliminary results indicate the existence of 60 visitor-created trails, 46 cliff-top impact sites, 6 base-impact sites, and 10 campsites.

Activities in FY2006 will focus on completion of inventory and assessment activities, outreach efforts, and synthesis of information into a Cliff Management Plan.

Wendy Cass is a Botanist.

Final Accuracy Assessment Completed for Park Vegetation Map

By Wendy Cass

Delivery of the 2005 vegetation map was delayed until February 2006 to accommodate additional accuracy assessment data collection and map revisions. A field team of NPS technicians successfully negotiated park boundary access issues, steep terrain, and thick vegetation, to sample 64 additional accuracy assessment points. These data were added to that from 277 additional "paper" accuracy assessment points determined by Gary Fleming at the Virginia Department of Conservation and Recreation from existing Shenandoah plot data.

The additional data are being used to refine the boundaries of difficult to map vegetation associations (communities). It has also identified an additional vegetation association present in the park, bringing the total number of park vegetation associations to 35. The final vegetation map was delivered in February 2006 and included 15m resolution grid and polygon data of park plant communities.

Wendy Cass in a Botanist.

The Mid-Atlantic Exotic Plant Management Team: A Friend Indeed

By James Åkerson

Introduction

Shenandoah National Park has an ally in the battle against invasive exotic plants. During these extremely tight budget times at Shenandoah National Park, the Mid-Atlantic Exotic

The NPS Mid-Atlantic EPMT. From left-to-right: Dale Meyerhoeffer, Kate Jensen, Norman Forder, Kirill Kashin (Russian-SCA intern), Matthew Overstreet, and James Åkerson.

Plant Management Team (EPMT) provides field time for control treatments, technical expertise, and program leadership that supplements exotic plant control efforts by park staff. Shenandoah is part of a 14-park cooperative that works together and shares equipment and technical know-how. Features of the cooperative include collaboration with the Student Conservation Association, a private contractor, park neighbors, and outside agencies.

Highlights for Fiscal Year 2005:

- Treated 42.4 acres and retreated 25.9 acres (including 11 species) at Shenandoah National Park. Treatment focused on mile-a-minute vine, an extremely invasive plant, as well as princesstree, tree of heaven, and Oriental bittersweet.
- Shenandoah National Park initiated a program of short-term volunteer assistance in exotic plant control. A database was created and populated of available volunteers and potential

The Shenandoah National Park exotic plant management team. From left-to-right: Chris Carson, Heather Huntley (SCA), Andrea Salzman (SCA), Gail Butti (SCA), Wesley Finke (SCA), Jake Hughes (field leader), and James Åkerson. Not pictured is Rosa Palarino.

participating organizations. Groups such as schools, universities, clubs, and professional organizations were contacted and included. The database contained 156 records as of

The Shenandoah National Park short-term volunteer team. From left-to-right: Demorn Brown and Gail Butti.

October 2005. Short-term volunteer events to control exotic plants began in the fall of 2005.
- The Cooperative expanded its organizational capacity by utilizing a private sector contract to implement controls at Shenandoah and elsewhere, and by utilizing individual Student Conservation Association interns and park volunteers at Shenandoah. These measures resulted in excellent success.
- Increased public awareness of invasive problems was achieved by participating in five newspaper and magazine interviews, publishing five articles in professional journals and newsletters, speaking at seven public or professional meetings, and creating eleven reports

Natives such as the Virginia bluebells (pictured) as well as trillium, jack-in-the-pulpit, and others are threatened by mile-a-minute vine, the newest serious invader found in all three districts of Shenandoah National Park.

available to the public. Additionally, the team responded to public queries for information and school talks on 17 occasions.
- The team liaison provided technical expertise to the Commonwealth of Virginia's Invasive Species Council by participating in an effort to devise a state-wide invasive species strategic management plan. The statewide plan was presented to and approved by the council on December 13, 2005.
- Shenandoah National Park hosts the team and provides office and storage space, utilities, computer assistance, and administrative support. In return, the team liaison dedicates about 40 percent of his time to oversight of the park's exotics program; the field team works a share of their field time on park projects.

James Åkerson is a Supervisory Forest Ecologist and Team Liaison.

Streamwater Temperatures Ten Years After the Floods

By David Demarest

On June 27, 1995 two different storm cells pushed into Shenandoah National Park after four days of heavy rains had already saturated soils. These two cells dumped rain at a rate of about 19+ inches per hour. The result, in three drainages within the park, was a flood event of 1,500+ year's magnitude. Riparian canopy was lost below 1,600 feet in all three drainages. In May of 2000, a project utilizing miniature temperature recorders was undertaken to try to determine how much effect the lack of tree canopy had on the water temperature and brook trout (*Salvelinus fontinalis)* recovery within the North Fork Moormans and Rapidan River drainages. Brook trout young of the year tend to die at prolonged temperatures of 20 degrees celsius, while the adults cannot live in waters with prolonged temperatures over 25 degrees celsius.

Temperature loggers were installed within 50 meters of three fisheries monitoring transects on the North Fork Moormans and Rapidan River for a total of six logging sites. Each logger collects data once an hour and is downloaded in the field approximately every 70 days. The project has been plagued by theft, flood loss, hurricanes, data not collected often enough, and logger malfunctions. These problems have left some large holes in the data but the general year-to-year trends are the same.

Figure 1 is a representation of what the stream corridors looked like after the floods. All of the drainages had 80-100 percent canopy cover prior to the event. This photo was taken in the Staunton River drainage and shows the destruction to Wilson Run, one of its tributaries. Prior to the flood, Wilson Run had 100 percent canopy cover like the forest on its banks.

Figure 1. Photograph taken April 22, 1996, looking across the Staunton River at one of its tributaries, Wilson Run.

Seasonally high water temperature is thought to be the main reason brook trout have not fully re-colonized the lower reaches of these streams. Siltation is not thought to be a factor due to the numbers of other fish species present in the sampling sites. Figures 2 and 3 (page 16) are graphs of the mean daily temperatures of the North Fork Moormans and Rapidan Rivers upper and lower sites. Data from the middle sites were not included but their average temperatures are typically between those of the lower and upper sites. The middle site on the Moormans has temperatures nearly the same as the lower site. This is most likely due to its lack of riparian cover. The middle site and upper sites on the Rapidan have nearly the same temperatures because there is 90-100 percent riparian cover over the stream.

Trout populations have stayed at extremely low numbers at the lower site on the North Fork Moormans. As vegetation grows back on the stream banks, there has been a decrease in the number of average days above 20 degrees celsius. In the past year, brook trout numbers have increased slightly and there is now rainbow trout (*Oncorhynchus mykiss*), an exotic species, reproduction. Rainbow and brown trout (*Salmo trutta)*, another exotic, can tolerate warmer waters than the native brook trout. This new colonization of rainbows is unfortunate because the flood and a one-day eradication shocking effort in the fall of 1998 seemed to have extirpated the large brown trout population that existed prior to the flood.

In the lower Rapidan, there have been some residual brook trout, but this population has increased in the last two years. Average temperatures also stay much lower in the Rapidan than the Moormans. Unfortunately there was no money to replace the temperature loggers in the Moormans after a flood event in September 2004. The loggers were taken out of the Rapidan and put in the Moormans due to its lower trout populations and higher average temperatures.

The most stable and coolest temperatures are found at the upper sites in both drainages, which generally have deeper and swifter water and are fully shaded. This is where brook trout thrive and both streams have excellent populations in those areas. Without 40-50 percent canopy, the lower reaches of the

North Fork Moormans and the Rapidan will continue to be classified as poor to marginal trout waters. The good news is that after ten years, the shrubs on the stream banks are about 30-40 feet tall. This is an excellent rebound from a truly awesome natural event.

David Demarest is a Biological Science Technician.

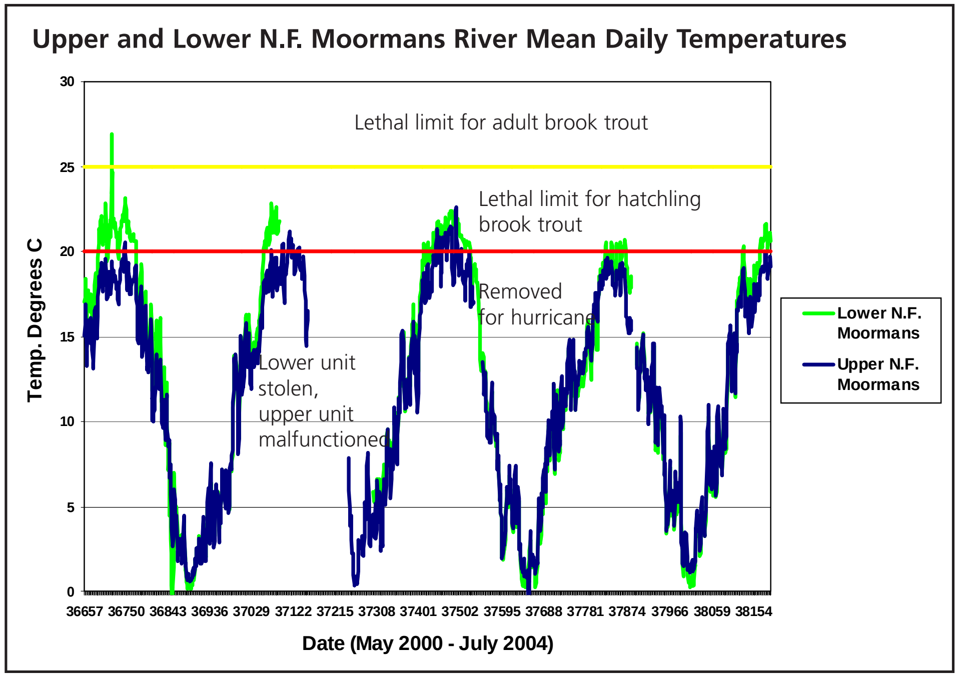


Figure 2. Upper and lower North Fork Moormans River mean daily temperatures, May 2000 to November 2005.

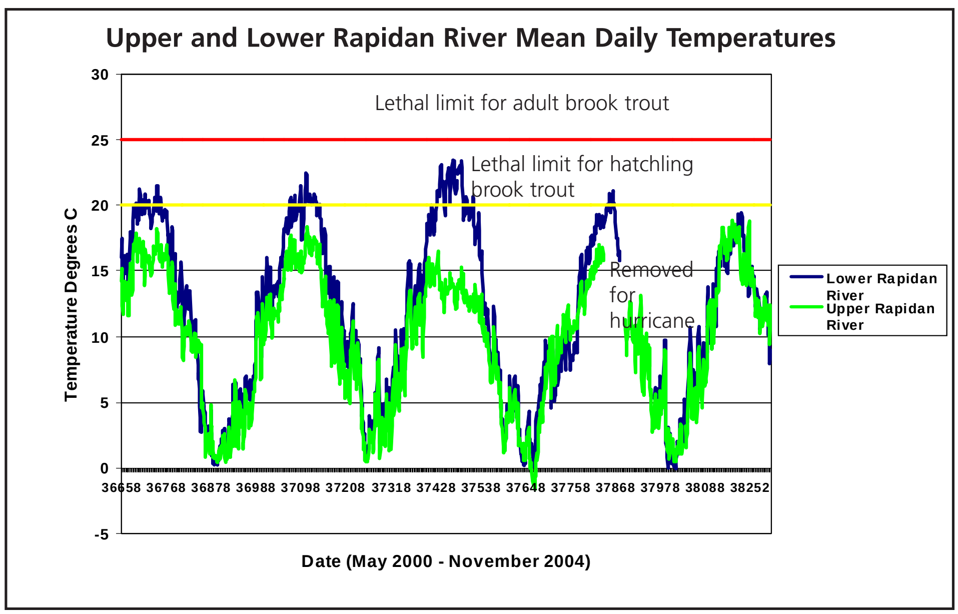


Figure 3. Lower and upper Rapidan River mean daily temperatures, May 2000 to November 2004.

Ozone Seasons -- 2003 and 2004

By Liz Garcia

The overall purpose of the National Park Service Gaseous Pollutant Monitoring Program (GPMP) is to establish and monitor the status and trends of each park unit ambient air quality conditions and to determine if the park is exceeding the National Ambient Air Quality Standards (NAAQS) set forth by the U.S. Environmental Protection Agency (EPA). These standards regulate ground-level ozone and sulfur dioxide and define the national targets for acceptable concentrations of each pollutant.

Data from Annual Data Summary 2003 and 2004

3-year Average	4th Highest Ozone Concentration
2002-2004	82 ppb
2001-2003	87 ppb *
2000-2002	85 ppb *
1999-2001	87 ppb *
1998-2000	93 ppb *
1997-1999	96 ppb *
1996-1998	92 ppb *
1995-1997	85 ppb *
1994-1996	83 ppb
* Indicates a violation.	

The NAAQS primary standard for ozone is 0.08 parts per million (ppm) over an 8-hour period. An exceedance of the standard occurs when the 8-hour ozone concentration is greater than or equal to 85 parts per billion (ppb). An exceedance is not the same as a violation. A violation occurs when the 3-year average of the fourth highest daily maximum 8-hour average ozone concentration equals or exceeds 85 ppb.

In 2003, there were six days where the ozone levels exceeded the standard. The first highest ozone level was 104 ppb. The fourth highest ozone level was 86 ppb, which helped keep the 3-year average of 87 ppb in violation of the NAAQS for the seventh year in a row.

In 2004, there was only one day where the ozone level exceeded the standard with a level of 87 ppb. The fourth highest ozone level was 75 ppb which helped drop the violation. The 3-year average dropped to 82 ppb.

When considering trends, it is important to remember that ozone is formed in sunlight by the reaction of nitrogen oxides (NO_x) and reactive volatile organic compounds (VOCs). NO_x emissions trends can relate to the trends in ozone production. In 1999, new NO_x emission controls were put in place on several large point sources in the midwest and portions of the south, thus reducing the production of NO_x in many eastern parks, including Shenandoah.

In observing the ozone trend at Shenandoah, we notice there really isn't much change overall. If we look back at the ozone data for the past 17 years, we find there is a slight increase (slope = 0.48) in the ozone trend based on linear regression. But since 1999, there has typically been a decreasing trend in ozone concentrations. If the existing NO_x emission controls are kept in place, this could be good news for future predictions of air quality in eastern parks and something that needs to be tracked carefully.

Liz Garcia is a Physical Science Technician.

Ambient Weather Data from Shenandoah National Park at the Big Meadows Air Quality Station

By Liz Garcia

Shenandoah National Park - Big Meadows Air Quality Site	2000	2001	2002	2003	2004
Ozone Exceedance (>=85ppb)	1	8	6	6	1
1st Highest, 8-hour Ozone Concentration (ppb)	93	95	101	104	87
4th Highest, 8-hour Ozone Concentration (ppb)	80	90	86	86	75
Sulfur Dioxide, Annual Arithmetic Mean (ppb)	2.5	2.3	2	2	2
Average Wind Speed (Scalar)	2.9	2.6	2.7	2.7	2.5
Average Ambient Temperature (°C)	7.6	8.8	9.6	7.5	8.2
Maximum Ambient Temperature (°C)	25.2	25.7	27.8	25.6	25.6
Minimum Ambient Temperature (°C)	-18.1	-14.2	-15.2	-20.1	-21.4
Average Relative Humidity (%)	66	71	73	76	73
Maximum Relative Humidity (%)	100	100	100	100	100
Minimum Relative Humidity (%)	8	10	5	12	4
Accumulated Precipitation (mm)	1040.9	965.5	1128.3	1736	1455

Big Meadows air quality site.

Liz Garcia is a Physical Science Technician.

Geologic Resource Evaluation

By Gordon Olson

In March 2005, park staff, Geologic Resources Division staff, and a variety of geologists from various agencies, universities, and organizations convened for a week to discuss the state of knowledge about and condition of park geologic resources. Discussions also focused on assimilation of mapped geologic information. This effort resulted in preparation of two important reports. One provides a summary of the park geology and issues associated with geologic resources while the other outlines what geologic maps are available for the park and which ones need to be converted to digital form.

This effort was particularly important for three primary reasons. First, a document is now available that can be used as a ready-reference regarding Shenandoah geologic resources. This should be useful in many park management applications. Second, this same document includes brief descriptions of geologic research projects that should be undertaken. This should be helpful to park staff when decisions are made regarding research priorities and can be used by cooperating scientists who may be interested in working in the park. Finally, the summary of geologic maps will be very useful as an interim product while the U.S. Geological Survey is preparing a comprehensive, up-to-date geologic map of the park. The updated map is not anticipated until 2008 at the earliest. Staff now has a comprehensive index to the map products that are currently available.

In the last newsletter, a brief report was filed on the park's Water Resources Scoping Report. The year before that, the newsletter reported on the Air Resources Assessment. These two documents, combined with those stemming from the geologic resource evaluation provide a reasonably thorough summary of our state of knowledge regarding physical sciences in the park. Within the next year, we anticipate completing a Natural Resources Assessment document. Heavy emphasis in this document will be placed on biological resources, thus completing this important suite of reports.

Gordon Olson is a Supervisory Biologist.

Virginia Comprehensive Wildlife Plan

By Gordon Olson

For slightly more than two years, the Virginia Department of Game and Inland Fisheries has been involved in an intensive planning effort aimed at laying the foundation for wildlife conservation efforts for decades to come. Mandated by federal law, this planning effort has focused on first identifying all animal species in the state and the health of those populations and condition of their habitats. The plan also provides some priorities amongst those species through a tiering system. Finally the plan includes discussions regarding the most significant threats to wildlife within Virginia and contains suggestions for strategies for dealing with those. Many parallels exist between this planning document and the former resources management plans that National Park Service units once prepared.

Input for the plan was sought on multiple levels including technical experts, department experts, an external steering committee, and the general public. Gordon Olson, from Shenandoah National Park, served on the external steering committee representing the interests of Shenandoah and all other units of the National Park Service in Virginia.

The first version of the plan was submitted to the U.S. Fish and Wildlife Service for review on October 1, 2005. Once approved, Virginia officials will move on to prepare an Implementation Plan that will outline specific projects and programs that are needed for wildlife conservation. The Implementation Plan will be the basis for making federal grants to Virginia for conservation measures. The National Park Service anticipates continued involvement as the implementation strategy is developed.

This state planning effort is particularly important to Shenandoah and other Virginia parks because it provides some baseline information, it communicates rough priorities from the state perspective, it acknowledges the roles of federal land managers in wildlife preservation and conservation, and it opens the door for collaboration and coordination related to wildlife.

Gordon Olson is a Supervisory Biologist.

Natural Resources Profiles

By Gordon Olson

Last year in this newsletter, it was reported that substantial work had been completed in the development of information to be posted on the World Wide Web related to park natural resources and natural resource management programs. The emphasis on preparation of this material slowed considerably during 2005 but some progress was made.

During 2005, the National Park Service decided to implement a new content management system for the existing standard websites that each of the units of the National Park System maintains. This new system will eventually provide a standard design and appearance for all park websites, will be able to handle more information than is currently accommodated, and will allow more flexibility in sorting and accessing information across the service. Concurrent with this decision, came the decision to not allow parks to maintain their own independent In Depth sites. The service is currently in the middle of the transition to this new system. These changes forced us to curtail our efforts related to Shenandoah's In Depth site and to limit the additions to the natural resources profiles.

Despite these interruptions, progress has been made. We have posted between 30 and 40 fact sheets (see related article on page 26) in the resource management documents page of the profiles. These provide comprehensive thumbnail sketches of the most important programs and projects we are engaged in.

Furthermore, a series of highlights have been added under the descriptions of plant life found in the park. Each highlight describes a single species and provides information regarding what is known about the species at Shenandoah as well as links for more detailed information. Highlights have only been written for plant species. This was done because the service has started implementing a nature guide feature within the profiles that provides similar information for wildlife. We hope this feature will be implemented for Shenandoah.

Transition to the new content management system is anticipated for early 2006 at Shenandoah. Once that has settled down, we will revisit the natural resources information and evaluate what our next steps should be. Stay tuned.

Gordon Olson is a Supervisory Biologist.

Rocks, Skeletons, and Skins -- Status of the Park's Natural History Collection

By Gordon Olson

Long neglected, but vitally important to park science, the park's natural history collection finally received essential time and attention. Modest but vital progress was made in the organization of the park's natural history collection during the past year. The following tasks were accomplished:

- Specimens and cabinets that remained at the Byrd Visitor Center were moved to the old painter's shop in the headquarter's maintenance area. This move means that all specimens and cabinets are now in one of three locations in close proximity to one another and all specimens are in somewhat improved storage locations (no longer exposed to rain, dust, and so forth). Eventually we would like to find a single location at which all museum specimens can be stored.
- Rock specimens have now been thoroughly reviewed by our resident volunteer geologist resulting in identification and improved organization within cabinets.
- Thanks to the assistance of two volunteers, substantial progress has been made in matching up cataloging records with specimens. Lots of work remains to be done on this tedious task but we are headed in the right direction.
- Park staff sponsored a single-day workshop with curators to discuss the park's scope of collection statement as it relates to natural history specimens. This was an extremely important step that is explained below.
- Initial work was done on revising the scope of collection statement to reflect decisions from the workshop.

The foundation for every park museum collection is a document called the scope of collection statement or simply the scope of collection. This document outlines exactly what is to be included in the park collection and is vital in controlling the number and breadth of the objects included in the collection. The current scope of collection for Shenandoah, as it relates to natural history specimens, is weak. As a result of the aforementioned workshop, it was recommended that the park maintain two collections. A reference collection, one that is used on a daily basis by staff and others to train, verify identifications, and provide general information. This collection would include specimens but for some categories it would simply include a library of good field guides and diagnostic tools. This collection would not meet strict National Park Service (NPS) museum collection standards and would not be cataloged in the standard system. The second collection is referred to as the museum collection. This is the collection of material that provides vouchers, or physical evidence that documents the presence of a given resource in the park at a given time. This collection would meet strict NPS museum standards for cataloging, storage, and access. During the next year, these concepts and other details that were discussed during the workshop will be folded into the scope of collection statement.

Future work on the natural history collection will be multi-faceted (splitting material between the two collections, conservation treatment of specimens, dealing with arsenic issues, updating cataloguing records, and so forth) but all will be aimed at bringing the collection in line with NPS policies and the park scope of collection.

Gordon Olson is a Supervisory Biologist.

Hard Decisions

By Gordon Olson

Introduction

The budget constraints of recent years have brought staffing and programming changes throughout the park. Beginning in FY2004, Shenandoah's Long-Term Ecological Monitoring Program started to undergo change. That year the park's largest bird monitoring effort (Monitoring Avian Productivity and Survivorship - MAPS) was suspended and significant cuts were made related to travel and supplies. Late in 2004 (first quarter of FY2005), park staff decided that it was necessary to make some additional significant changes in the park's monitoring program. Those changes included reduction of the funding provided to the University of Virginia to conduct water quality monitoring under the auspices of the Shenandoah Watershed Study (SWAS), and institution of a rotation of other major monitoring program components. The monitoring rotation moved all of the park's major monitoring programs from annual activity to being active only on alternate years. Within this rotation fish and aquatic invertebrate programs would rotate with forest vegetation and rare plant programs, each being implemented every other year.

Each of these changes has had its origin in the financial difficulties the park has been facing. Reduced funding has forced change. This article briefly explains the complexity of decision-making as it relates to long-term monitoring, what changes have been made, why the specific changes were made, and, finally, what the future may hold.

Natural Resource Monitoring – A Complicated Business

To fully appreciate the changes that have been made in the park's monitoring program, it is essential that a number of underlying concepts be reviewed and understood. The following is an excerpt from a document (Phase I Report) recently prepared for the Mid-Atlantic Inventory and Monitoring Network (MIDN). Shenandoah is a full participant in this network. The excerpt explains why monitoring is conducted in parks, the relationship of monitoring to other resource management activities, how decisions are made regarding what to monitor, and what general limitations are imposed on monitoring.

> **Justification for monitoring -** Knowing the condition of natural resources in national parks is fundamental to the Service's ability to manage park resources "unimpaired for the enjoyment of future generations". National Park managers across the country are confronted with increasingly complex and challenging issues that require a broad-based understanding of the status and trends of park resources as a basis for making decisions and working with other agencies and the public for the benefit of park resources. For years, managers and scientists have sought a way to characterize and determine trends in the condition of parks and other protected areas to assess the efficacy of management practices and restoration efforts and to provide early warning of impending threats. The challenge of protecting and managing a park's natural resources requires a multi-agency, ecosystem approach because most parks are open systems, with threats such as air and water pollution, or invasive species, originating outside of the park's boundaries. An ecosystem approach is further needed because no single spatial or temporal scale is appropriate for all system components and processes; the appropriate scale for understanding and effectively managing a resource might be at the population, species, community, or landscape level, and in some cases may require a regional, national or international effort to understand and manage the resource. National parks are part of larger ecosystems and must be managed in that context.
>
> Natural resource monitoring provides site-specific information needed to understand and identify change in complex, variable, and imperfectly understood natural systems and to determine whether observed changes are within natural levels of variability or may be indicators of unwanted human influences. Thus, monitoring provides a basis for understanding and identifying meaningful change in natural systems characterized by complexity, variability, and surprises. Monitoring data help to define the normal limits of natural variation in park resources and provide a basis for understanding observed changes; monitoring results may also be used to determine what constitutes impairment and to identify the need to initiate or change management practices. Understanding the dynamic nature of park ecosystems and the consequences of human activities is essential for management decision-making aimed to maintain, enhance, or restore the ecological integrity of park ecosystems and to avoid, minimize, or mitigate ecological threats to these systems (Roman and Barrett 1999).
>
> The intent of park vital signs monitoring is to track a subset of physical, chemical, and biological elements and processes of park ecosystems that are selected to represent the overall health or condition of park resources, known or hypothesized effects of stressors, or elements that have important human values. The elements and processes that are monitored are a subset of the total suite of natural resources that park managers are directed to preserve "unimpaired for future generations," including water, air, geological resources, plants and animals, and the various ecological, biological, and physical processes that act on those resources. In situations where natural areas have been so highly altered that physical and biological processes no longer operate (e.g., control of fires and floods in developed areas), information obtained through monitoring can help managers understand how to develop the

most effective approach to restoration or, in cases where restoration is impossible, ecologically sound management. The broad-based, scientifically sound information obtained through natural resource monitoring will have multiple applications for management decision-making, research, education, and promoting public understanding of park resources.

The role of inventory, monitoring and research in resource management - Monitoring is a central component of natural resource stewardship in the National Park Service, and in conjunction with natural resource inventories and research, provides the information needed for effective, science-based managerial decision-making and resource protection. Ecological monitoring establishes reference conditions for natural resources from which future changes can be detected. Over the long term, these "benchmarks" help define the normal limits of natural variation and may become standards with which to compare future changes, provide a basis for judging what constitutes impairment, and help identify the need for corrective management actions.

The NPS strategy to institutionalize inventory and monitoring throughout the agency consists of a framework having three major components: (1) completion of 12 basic resource inventories upon which monitoring efforts can be based; (2) a network of 11 experimental or "prototype" long-term ecological monitoring (LTEM) programs begun in 1992 to evaluate alternative monitoring designs and strategies; and (3) implementation of operational monitoring of critical parameters (i.e. "vital signs") in approximately 270 parks with significant natural resources that have been grouped into 32 vital sign networks linked by geography and shared natural resource characteristics.

Strategies for determining what to monitor - Monitoring is an on-going effort to better understand how to sustain or restore ecosystems, and serves as an "early warning system" to detect declines in ecosystem integrity and species viability before irreversible loss has occurred. One of the key initial decisions in designing a monitoring program is deciding how much relative weight should be given to tracking changes in focal resources and stressors that address current management issues, versus measures that are thought to be important to long-term understanding of park ecosystems. However, our current understanding of ecological systems and consequently, our ability to predict how park resources might respond to changes in various system drivers and stressors is poor. A monitoring program that focuses only on current threat/response relationships and current issues may not provide the long-term data and understanding needed to address high-priority issues that will arise in the future. Ultimately, an indicator is useful only if it can provide information to support a management decision or to quantify the success of past decisions, and a useful ecological indicator must produce results that are clearly understood and accepted by managers, scientists, policy makers, and the public. Should vital signs monitoring focus on the effects of known threats to park resources or on general properties of ecosystem status? Woodley (1993), Woodward et al. (1999), and others have described some of the advantages and disadvantages of various monitoring approaches, including a strictly threats-based monitoring program, or alternate taxonomic, integrative, reductionist, or hypothesis-testing monitoring designs (Woodley 1993, Woodward et al., 1999). The approach adopted by MIDN agrees with the assertion that the best way to meet the challenges of monitoring in national parks and other protected areas is to achieve a balance among different monitoring approaches, while recognizing that the program will not succeed without also considering political issues. We have adopted a multi-faceted approach for monitoring park resources, based on both integrated and threat-specific monitoring approaches and building upon concepts presented originally for the Canadian national parks (Woodley 1993). Indicators in each of the following broad categories may be chosen:

(1) **ecosystem drivers** that fundamentally affect park ecosystems,
(2) **stressors** and their ecological effects,
(3) **focal resources** of parks, and
(4) **key properties and processes of ecosystem integrity**.

Natural ecosystem drivers are major external forces such as climate, fire cycles, biological invasions, hydrologic cycles, and natural disturbance events such as earthquakes, droughts, and floods. These can have large-scale influences on natural systems. Trends in ecosystem drivers will suggest what kind of changes to expect and may provide an early warning of presently unseen changes in the ecosystem.

Stressors are physical, chemical, or biological perturbations to a system that are either (a) foreign to that system, or (b) natural to the system but applied at an excessive [or deficient] level (Barrett et al. 1976:192). Stressors cause significant changes in the ecological components, patterns, and processes in natural systems. Examples include water withdrawal, pesticide use, timber harvesting, traffic emissions, stream acidification, trampling, poaching, land-use change, and air pollution. Monitoring of stressors and their effects, where known, will ensure short-term relevance of the monitoring program and provide information useful to management of current issues.

Focal resources, by virtue of their special protection, public appeal, or other management significance, have paramount importance for monitoring regardless of current threats or whether they would be monitored as an indication of ecosystem integrity. Focal resources might include ecological processes such as deposition rates of nitrates and sulfates in certain parks, or they may be a species that is harvested, endemic, alien, or has protected status.

Monitoring of **key properties and processes of ecosystem**

integrity will provide the long-term baseline needed to judge what constitutes unnatural variation in park resources and provide early warning of unacceptable change. Biological integrity has been defined as the capacity to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats of the region (Karr and Dudley 1981).

Ecological integrity is the summation of physical, chemical, and biological integrity, and it implies that ecosystem structures and functions are unimpaired by human-caused stresses. Indicators of ecosystem integrity are aimed at early-warning detection of presently unforeseeable detriments to the sustainability or resilience of ecosystems. Collectively, these basic strategies for choosing vital signs achieve the diverse monitoring goals of the National Park Service.

Integration: ecological, spatial, temporal and programmatic - One of the more challenging aspects of designing a comprehensive monitoring program is integration of monitoring projects so that the interpretation of the whole monitoring program yields information more useful than that of individual parts. Integration involves ecological, spatial, temporal and programmatic aspects:

Ecological Integration involves considering the ecological linkages among system drivers and the components, structures, and functions of ecosystems when selecting vital signs. An effective ecosystem monitoring strategy will employ a suite of individual measurements that collectively monitor the integrity of the entire ecosystem. One approach for effective ecological integration is to select vital signs at various hierarchical levels of ecological organization (e.g., landscape, community, population, genetic; see Noss 1990).

Spatial Integration involves establishing linkages of measurements made at different spatial scales within a park or network of parks, or between individual park programs and broader regional programs (i.e., NPS or other national and regional programs). It requires understanding of scalar ecological processes, the co-location of measurements of comparably scaled monitoring indicators, and the design of statistical sampling frameworks that permit the extrapolation and interpolation of scalar data.

Temporal Integration involves establishing linkages between measurements made at various temporal scales. It will be necessary to determine a meaningful timeline for sampling different indicators while considering characteristics of temporal variation in these indicators. For example, sampling changes in the structure of a forest overstory (e.g., size class distribution) may require much less frequent sampling than that required to detect changes in the composition or density of herbaceous groundcover. Temporal integration requires nesting the more frequent and, often, more intensive sampling within the context of less frequent sampling.

Programmatic Integration involves the coordination and communication of monitoring activities within and among parks, among divisions of the NPS Natural Resource Program Center (NRPC), and among the NPS and other agencies, to promote broad participation in monitoring and use of the resulting data. At the park or network level, for example, the involvement of a park's law enforcement, maintenance, and interpretative staff in routine monitoring activities and reporting results in a well-informed park staff, wider support for monitoring, improved potential for informing the public, and greater acceptance of monitoring results in the decision-making process. The systems approach to monitoring planning and design requires a coordinated effort by the NRPC divisions of Air Resources, Biological Resource Management, Geologic Resources, Natural Resource Information, and Water Resources to provide guidance, technical support and funding to the networks. Finally, there is a need for the NPS to coordinate monitoring planning, design and implementation with other agencies to promote sharing of data among neighboring land management agencies, while also providing context for interpreting the data.

Limitations of the monitoring program - Managers and scientists need to acknowledge limitations of the monitoring program that are a result of the inherent complexity and variability of park ecosystems, coupled with limited time, funding, and staffing available for monitoring. Ecosystems are loosely-defined assemblages that exhibit characteristic patterns on a range of scales of time, space, and organization complexity (De Leo and Levin 1997). Natural systems as well as human activities change over time, and it is extremely challenging to separate natural variability and desirable changes from undesirable anthropogenic sources of change to park resources. The monitoring program simply cannot address all resource management interests because of limitations of funding, staffing, and logistical constraints. Rather, the intent of vital signs monitoring is to monitor a select set of ecosystem components and processes that reflect the condition of the park ecosystem and are relevant to management issues. Cause and effect relationships usually cannot be demonstrated with monitoring data, but monitoring data might suggest a cause and effect relationship that can then be investigated with a research study. As monitoring proceeds, as data sets are interpreted, as our understanding of ecological processes is enhanced, and as trends are detected, future issues will emerge (Roman and Barrett 1999). The monitoring plan should therefore be viewed as a working document, subject to periodic review and adjustments over time as our understanding improves and new issues and technological advances arise. (Comiskey 2005)

Full citations for references used in the above extract are available from the Natural Resources Branch.

While the above excerpt is lengthy, the discussion clearly points to the complexity and difficulty associated with determining what to monitor. Similarly, it becomes more difficult at the point of deciding what not to monitor after substantial investments have been made.

FY2004 Changes - During FY2004, modest funding reductions resulted in the elimination of the bird monitoring program (MAPS) and reductions related to travel and supplies. The MAPS program was selected primarily because it was not tied directly to other aspects of monitoring either operationally or in terms of data integration. Furthermore, similar decisions were being made elsewhere in the Service. None of this is to say that the MAPS data were not useful; they were. In addition, the park had established a 10+ year record of MAPS data. The continuity of that record has now been broken. Cuts related to travel and supplies were made because they are relatively easy to do and generally don't threaten the integrity of ongoing programs. In the long run, however, a failure to invest in the training of professional scientific staff via travel to conferences and workshops diminishes their currency and effectiveness.

FY2005 Changes - Early in FY2004 it was recognized that further changes in the park's monitoring program would be needed during FY2005 to meet anticipated funding levels. With this in mind, the natural resources staff broke into two working groups to explore possible acceptable scenarios for continuing the park's monitoring program. In addition to the side board of dealing with less funding, the groups were challenged with finding a way to fund two biological science technician positions that would be working year-round or nearly so. Up to this point, only one permanent lead biological science technician was on the staff. That position was giving primary support to park wildlife and aquatic programs. Professionals within the Natural Resources Branch working in native and exotic vegetation management needed technical support to improve efficiency and effectiveness.

Following a series of meetings, both work groups came to a consensus and recommended that the following changes be made:

- conduct forest vegetation and rare plant monitoring every other year
- conduct fisheries and aquatic invertebrate monitoring every other year opposite to the vegetation monitoring
- reduce the number of seasonal employees hired in any given year
- hire two permanent lead biological science technicians (these eventually became term, subject to furlough positions)
- have all three lead biological science technicians function as a team working across disciplines
- reduce the funding provided to the University of Virginia for SWAS

These recommendations were subsequently implemented in FY2005.

Clearly these changes have some downsides. The chances of detecting some changes will be lost because some data are collected less frequently. Precipitation chemistry data will not be collected by the University of Virginia (they will rely on our Big Meadows station). Finally, the rotation requires staff to make shifts in programs each year resulting in annually storing equipment and subsequently bringing equipment on line. Like suspension of the MAPS program, continuity in several programs would be lost although there are compelling circumstances that ameliorate this. For instance, the forest vegetation monitoring program was already undergoing substantial change, forest plants infrequently respond to environmental change so quickly that change would be detected between two years, and many sampling sites (fish, forest vegetation, and rare plants) were not visited every year anyway.

Aside from the financial benefit, these changes result in improved support to professional staff, program stability should professional or technical staff move on, increased ability of professional staff to prepare proposals, reports and analyze data, and better quality monitoring data because the same technicians are in the field year after year. In addition, cooperators, particularly the University of Virginia, are now working more aggressively to locate funding from non-NPS sources that can be used to sustain monitoring.

And What of the Future…

By the time this newsletter goes to press, park staff will have met to discuss the successes and difficulties encountered in implementing the monitoring rotation. That discussion may reveal further opportunities for improvements and perhaps some unanticipated benefits. After one year of implementation it appears that an added benefit has been greater efficiency in the field with the presence of more knowledgeable staff deployed on field tasks.

Park finances are at and will be at a difficult stage for the near future. Clearly the natural resources staff stands ready to make adjustments, as demonstrated by these changes. Concurrently, we are extremely committed to the importance and value of ecological monitoring and will work to assure the integrity of this program. We will work to find alternative solutions to implementing monitoring programs and we will work to educate others about the importance of the information we develop.

Monitoring requires long-term dedication to achieve sound and worthwhile scientific results. This means having funding, staffing, staff focus, and outward support available. It also means interest and dedication even when hard decisions need to be made. We cannot do this alone. We need your help as we strive to protect our nationally significant natural resources.

Literature Cited

Comiskey, J., K. Callahan, and C. Davis. 2005. Mid-Atlantic Network Vital Signs Monitoring Plan: Phase One. Mid-Atlantic Network, Inventory and Monitoring Program, National Park Service, Fredericksburg, Virginia.

Gordon Olson is a Supervisory Biologist.

Producing New Electronic Documents with Standard Formatting Using a Database

By Alan Williams

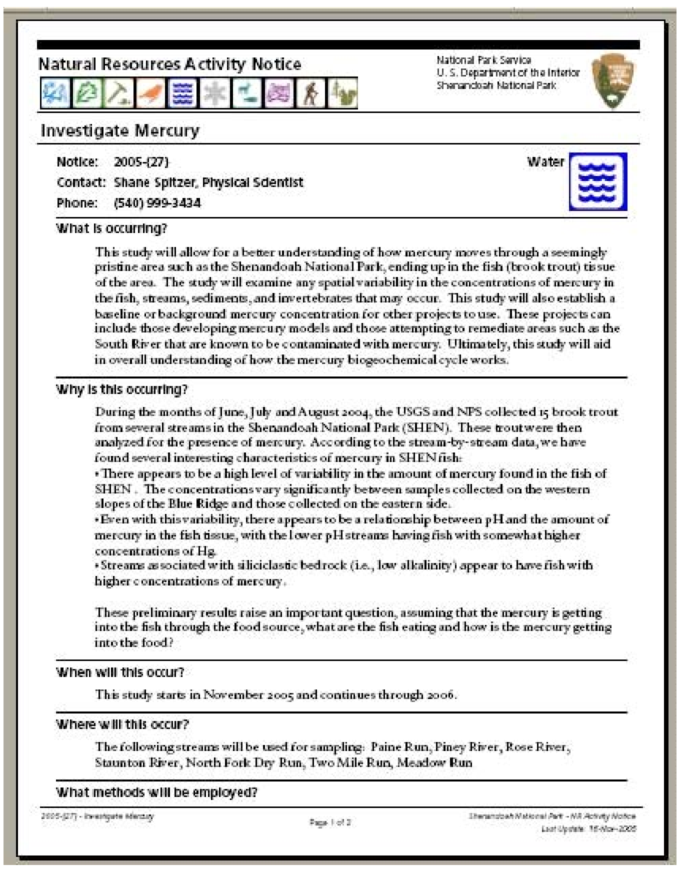
Anyone who has had to produce or read a lot of similar documents can tell you having a standardized format or layout for your written material has many benefits. Benefits to the producer include: maintaining a consistent look and feel for a series of documents, helping to minimize missing document sections, and helping to mass produce many similar documents. Benefits to the reader include: getting used to a format, being familiar with where to locate specific pieces of information, and recognizing a valid corporate entity. For some types of documents, the benefits of using some form of standardized format can outweigh the additional work required to implement the standard using a more complicated method.

We have used a variety of techniques to assist us in producing standardized documents in the past. Typically, we would take a template document with section placeholders or a copy of a report and then proceed to edit it with the new information. This technique can work well for project reports that might come out regularly with little content change from update to update. But if lots of changes are required, there is more room for layout mistakes and inconsistencies which in the end might not result in time savings.

Recently the Natural Resource Branch started producing a set of 'activity notices' and 'fact sheets'. The activity notices were designed for park staff and are to describe and give specific details about each of the projects/activities being undertaken by the branch. The fact sheets were designed for the public and were to highlight current projects and give general information about many aspects of the branch operations (currently available at: http://www.nps.gov/shen/pphtml/managementdocuments.html). The idea was to produce short, small documents that could be made available via the web. We started using the 'template' approach but decided we wanted to streamline and centralize the process to make it easier to create the consistent layout/format we wanted.

To do this, we use custom MS Access database applications for activity notices and for fact sheets to collect, organize, format, and export the information. The databases are setup on our park network in a shared location so that all of the resource staff can access them. Then, when they need to create a new document they go into the database and fill in the predefined fields required for each of the document types. The data entry form is set up so that the user either pastes or types the text for a particular section into the appropriate field on the MS Access form. Then they can optionally link to photos with captions to add more interest to the final document. Once they have finished the data entry, they can instantly preview the final product in the appropriate standardized format. The text is reviewed and edited by the branch chief then the final products are exported via preformatted MS Access reports and saved into the portable document format (PDF) using Adobe Acrobat software. Final fact sheets conform to the layout and appearance standards set by the National Park Service (NPS) Graphic Identity Program. These PDF documents are then distributed for park and public use. This system is a simple version of what is known as a content management system (CMS). Many of these systems exist for the web development world and are the standard for maintaining most large corporate websites including www.nps.gov.

There are advantages and disadvantages to our custom MS Access CMS. Some of the advantages are that everyone goes to a centralized location for the document production, the layouts are all identical, and there are less draft documents to confuse the writer or editor. Also, if the formatting needs to be changed on the documents (e.g., changing the position of the NPS arrowhead), the MS Access report is modified then all of the documents are re-exported in a matter of minutes.


Natural Resources Activity Notice

National Park Service
U. S. Department of the Interior
Shenandoah National Park

Investigate Mercury

Notice: 2005-(27)
Contact: Shane Spitzer, Physical Scientist
Phone: (540) 999-3434

Water

What is occuring?

This study will allow for a better understanding of how mercury moves through a seemingly pristine area such as the Shenandoah National Park, ending up in the fish (brook trout) tissue of the area. The study will examine any spatial variability in the concentrations of mercury in the fish, streams, sediments, and invertebrates that may occur. This study will also establish a baseline or background mercury concentration for other projects to use. These projects can include those developing mercury models and those attempting to remediate areas such as the South River that are known to be contaminated with mercury. Ultimately, this study will aid in overall understanding of how the mercury biogeochemical cycle works.

Why is this occurring?

During the months of June, July and August 2004, the USGS and NPS collected 15 brook trout from several streams in the Shenandoah National Park (SHEN). These trout were then analyzed for the presence of mercury. According to the stream-by-stream data, we have found several interesting characteristics of mercury in SHEN fish:

- There appears to be a high level of variability in the amount of mercury found in the fish of SHEN . The concentrations vary significantly between samples collected on the western slopes of the Blue Ridge and those collected on the eastern side.
- Even with this variability, there appears to be a relationship between pH and the amount of mercury in the fish tissue, with the lower pH streams having fish with somewhat higher concentrations of Hg.
- Streams associated with siliciclastic bedrock (i.e., low alkalinity) appear to have fish with higher concentrations of mercury.

These preliminary results raise an important question, assuming that the mercury is getting into the fish through the food source, what are the fish eating and how is the mercury getting into the food?

When will this occur?

This study starts in November 2005 and continues through 2006.

Where will this occur?

The following streams will be used for sampling: Paine Run, Piney River, Rose River, Staunton River, North Fork Dry Run, Two Mile Run, Meadow Run

What methods will be employed?

2005-(27) - Investigate Mercury

Page 1 of 2

Shenandoah National Park - NR Activity Notice

Example Activity Notice

This is far easier than manually reformatting many documents. Some of the disadvantages are:

- there can be a good deal of set-up to get the formatting and layout that is desired. (Many of the custom layout options available in word processors are not available or are difficult to implement in a MS Access report.)
- the data entry step takes some getting used to; and
- it takes extra work to handle documents with many linked or related graphs and tables.

Natural Resource Fact Sheet

National Park Service
U. S. Department of the Interior
Shenandoah National Park

Peregrine Falcon Restoration and Tracking

Introduction

Prior to the DDT era, there were approximately 24 peregrine aeries in the Virginia Appalachians (Watts, 2002). Following the initiation of a peregrine reintroduction program in the 1970s, peregrines nested successfully in Virginia in 1980 for the first time since the DDT era. Over the last two decades, the Virginia coastal populations of American peregrine falcons have made a slow and steady recovery while the mountain populations have lagged behind. In fact, the number of mountain breeding pairs over the last 12 years, have only met one third of the recovery goal set by the U.S. Fish & Wildlife Service (USFWS) for the Southern/Central Appalachians. The peregrine falcon is currently listed as Threatened under Virginia law.

Management Needs

Despite past recovery efforts, peregrines have been slow to re- colonize the mountains of Virginia. The only documented nesting in the Virginia Mountains took place from 1994- 1998 in Shenandoah National Park where eight young were fledged over five years. To address this need, in 2000, Shenandoah National Park began working cooperatively with the Center for Conservation Biology at William and Mary (CCB) and Virginia Department of Game and Inland Fisheries (VDGIF) to boost peregrine populations in the Virginia Mountains via relocation and release.

Current Procedures

The Foster Falcon Program is a peregrine restoration partnership between the CCB, the VDGIF, and Shenandoah National Park that involves removing at- risk peregrine chicks from Virginia coastal bridge nests (where fledging survival rates have been poor due to premature fledging over open water), relocating them to the park, and hacking and releasing them in the park at historic aeries.

Hacking, the controlled release of young falcons from an artificial or natural aerie provides a means of building flight skills, independence, and strength prior to release. This technique has proven to be useful for the reintroduction of peregrines and many other species to the wild. The hacking process involves the use of a hack box (protective box) to house birds during the preflight period, the release of birds, the provisioning of birds before and after fledging, and the monitoring of young falcons to independence. The hackbox is placed on a high cliff ledge that mimics a natural peregrine falcon nest scrape. The boxes are constructed so that the young birds can view and acclimate to their environment as they mature, but are protected from predators such as raccoons (they are also designed to minimize contact with humans). Ultimately, the intent is that hacked falcons will imprint on Shenandoah's prominent cliffs and return as breeding adults in two to three years. All management activities are performed by a small team of hacksite attendants.

EXPERIENCE YOUR AMERICA

Page 1 of 2

Example Fact Sheet

Our assessment is that, though our system is not practical for many types of documents requiring custom formatting and layouts, it may well be worth the effort for document series, documents with regular updates, and for documents with consistent sections and layout requirements.

Alan Williams is an Ecologist.

Through Solid Rock

By Reed Engle

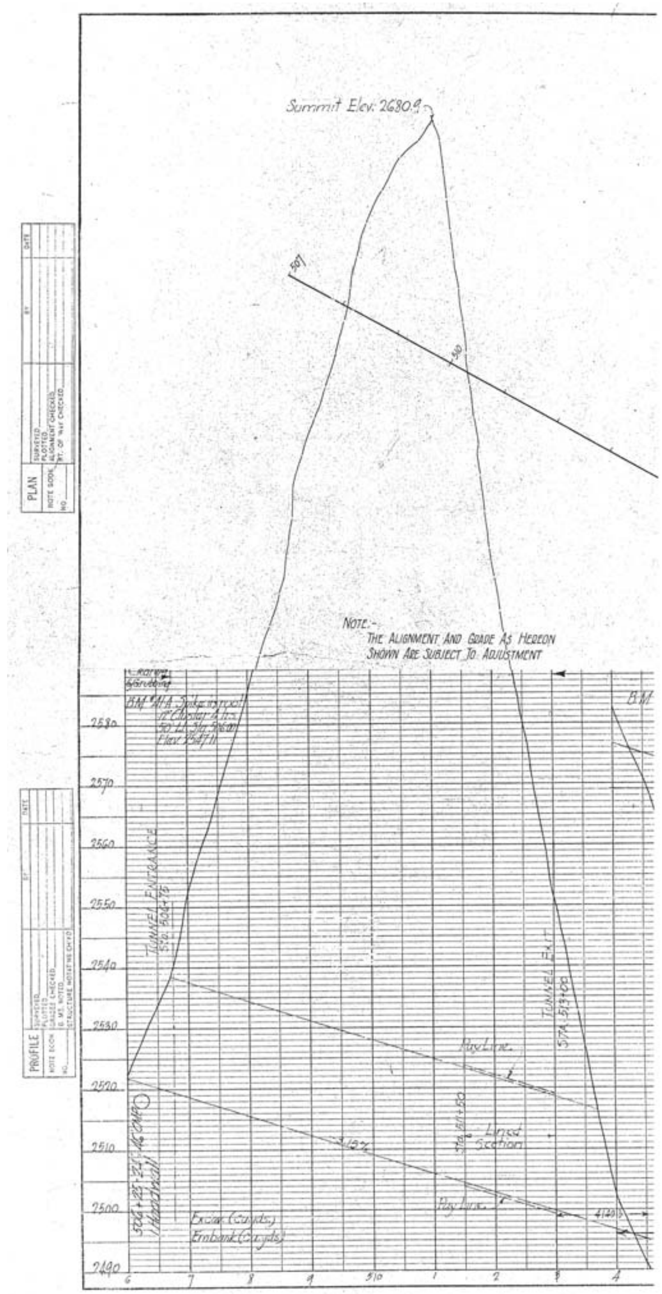
The Marys Rock Tunnel excites few of today's Shenandoah National Park's visitors, although some do stop to take photographs near the south portal. People today are used to far longer modern tunnels, but in 1931 visitors were thrilled by the engineering feat, and the tunnel on the Skyline Drive was a much-admired curiosity. Because of its novelty, Marys Rock Tunnel became an iconic image used on almost all early park souvenirs.

By the middle of the 19th, century railroad and canal companies engineered, designed, and built tunnels—they had no choice but to go through high ground they could not go around. Highway engineers and landscape architects learned from railroad technology. The single-lane 900 feet long Nada Tunnel in Red River Gorge in Kentucky was completed in 1911. The Columbia River Highway near Portland, Oregon completed in 1921 included three tunnels. A few cities built tunnels under adjacent rivers: Chicago's Washington Street Tunnel completed in 1869 was one of the earliest, but it was not until the third decade of the 20th century that urban tunnels such as New York's Holland Tunnel (1927) became more common.

The early Hoover-era Great Depression public works funding, the labor force of the Civilian Conservation Corps, and the funding from FDR's Public Works Administration led to a binge of National Park Service tunnel construction during the 1930s. Because most national parks were in rugged terrain not suitable for road building, tunnels provided an alternate for the massive scars that could have been created had traditional road techniques been used. The 5,613-foot long Zion-Mount Carmel Tunnel in Zion National Park was dedicated in 1930, before the Roosevelt programs. Four tunnels, however, were constructed in Yosemite National Park during the Roosevelt years, with the first dedicated in 1933, as was Glacier National Park's Going-to-the-Sun Highway tunnel. In the late 1930s three tunnels were completed in Great Smoky Mountains National Park, and twenty-six tunnels on the Blue Ridge Parkway were constructed from 1935-1966.

Yet it was not until the Pennsylvania Turnpike was completed in 1940 that tunnels were accepted as a routine part of highway construction in the eastern states. Built partially on a former railroad right of way, the "tunnel turnpike" incorporated six recycled rail tunnels and one new one.

The decision to build the tunnel at Marys Rock was made by the Bureau of Public Roads (BPR) with the concurrence of the National Park Service. The agencies were truly between a very large rock and a steep place. As seen in Illustration one, the summit of Marys Rock is almost 200 feet above the floor of the tunnel, and the roadway on either side was designed to meet the contours of the mountains and to meet



Detail from the "Plans for Proposed Project No. 1 Section Blue Ridge Skyline Drive", signed by the NPS and the BPR, June 9, 1931, and used for construction bids.[1] The engineering centerline cross-section has a horizontal scale in units of 100 feet and a typical engineer's vertical scale in units of 10 feet, thereby greatly exaggerating the vertical proportions. Note, however, how Marys Rock (summit marked 2,680.9 feet) goes well off the standard engineering grid paper. The proposed tunnel is shown as twin diagonal lines near the bottom of the sheet. The tunnel starts at an elevation of 2,494 feet above sea level at the south portal and rises to 2,522 feet at the north portal, a gentle 3.15% grade change.

[1] NA, RG 79, 330, 14, 23, 1-3

Panorama at the crest of the Blue Ridge. If the roadway hadn't gone through the mountain, the rock ridge would have had to have been cut back at least a thousand feet to the west, creating a 500-foot high slope at a 1:1 (45 degree) angle. Clearly such an excavation would have been tremendously expensive, would have created a massive quantity of waste material, and would have resulted in an unsightly scar, subject to landslides. Tunneling was the only logical choice.

After first reviewing the drawings, Assistant Landscape Architect Peterson wrote to BPR's Bishop questioning how the tunnel entrance portals would be treated:

> If the tunnel idea is to be carried out do you think that the rock will break nicely at the portal or will it be necessary to build up a new facing?
>
> You probably remember that both conditions existed at the Zion-Mt. Carmel tunnels [where one portal had to be faced with stone and the other was left unfaced].[2]

Peterson and Bishop deferred a decision on an artificial entrance until construction determined how the rock in the ridge split.

The public was enthralled with the project. The Madison Eagle reported in November 1931:

> An average of 1,000 pounds of dynamite is being used daily…. Five hundred pounds… is loaded into 40 holes and set off by electricity twice in 24 hours. These holes are drilled to a depth of 12 feet, three or four feet apart, over the face wall at the end of the tunnel, the object being to carry the tunnel back at its full height and width all the time. Every day 15 or more feet of solid rock are eaten away by the blasts….

North End of Marys Rock: Although the road bed from Panorama to the north end of the proposed Marys Rock Tunnel had been temporarily graded by late Autumn 1931, the contractors would not break through from the south until January. Note the highly unstable rock slopes above what would become the tunnel portal. These slopes later required the construction of terraced retaining walls.

> Work is progressing steadily and satisfactorily and the tunnel should be driven through by some time in January…. After the blast goes off with a mighty roar it requires two to three hours to clear away the loose boulders and stone and to roll them over the side of the dizzy fill at the mouth of the tunnel. Three 8-hour shifts of about 15 men each are on duty…the machinery never being idle except on Sunday…. The labor on the job is paid from 20 to 35 cents an hour.[3]

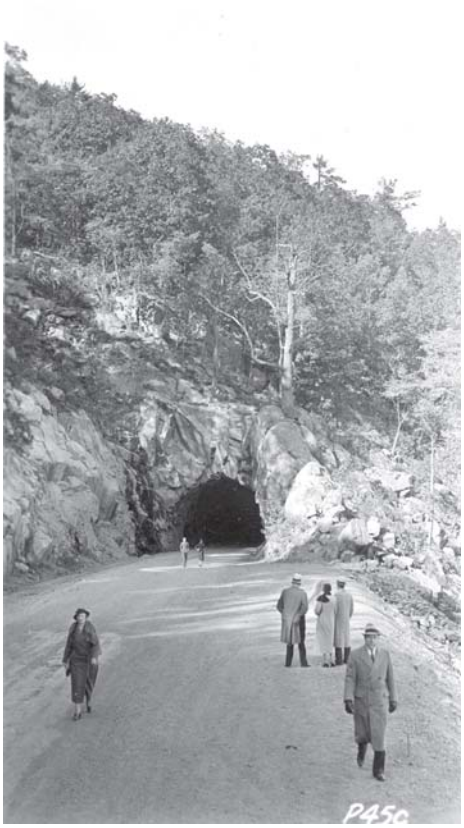
In January 1932, the blasting broke through the north portal of the tunnel; almost 11,000 cubic yards of granite had been removed. Within a week traffic was streaming through, although the roadway was not officially open.[4]

Peterson wrote to Bishop on January 29, 1932:

> I have just visited the Shenandoah Park project with Mr. Austin [BPR] and Mr. Ludgate [Asst. Landscape Architect, NPS, Eastern Division]. On this occasion we inspected the Mary's Rock tunnel, which is now at least roughly completed. We are of the opinion that since the rock broke so nicely around the natural portal, that it would not be wise to build any architectural masonry portals on either end….
>
> It is, however, recommended, and I know you will agree, that some measures be taken to retain the sliding… slope above the north portal. The best way to do this, we feel, is to anchor weather rock from the surrounding slopes into the barren patch above the tunnel entrance in a naturalistic way with large cavities holding earth in which a planting of native shrubs and trees can be made. The most desirable effect is a perfectly natural one of imitating the surrounding slopes. A project of this sort was carried out in one of the Rockefeller carriage roads on the side of Jordan Pond in Acadia National Park. This tunnel work, however, would not be nearly so extensive or costly. It is, however, rather exacting type of work and it will be necessary for Mr. Ludgate, as Landscape Architect, to be continuously on hand during its progress.[5]

Bishop responded to Peterson on February 1 that he was in complete agreement about the tunnel portals.[6] But Peterson's plan to anchor boulders in a naturalistic manner to stop rockslides adjacent to the north portal, if it ever was executed, did not work.

[2] Peterson to Bishop, April 29, 1931, NA, NPS, Box # 455
[3] Quoted in Lambert, Administrative History …., p. 113
[4] Ibid.
[5] NA, NPS, Box # 455
[6] Ibid.



South Portal of the Tunnel, October 1933: Although the Skyline Drive was closed to automobiles because the roadbed had still not been paved and guard walls, guardrails, and overlooks not yet completed, visitors walked from Panorama to view the new tunnel. The tunnel had not yet been widened to provide room for a gutter on the west (left) side and a sidewalk on the east. Note the numerous large boulders on the slopes above the portal.

By July 1934 the north portal of the tunnel was again being discussed because rockslides were impacting the roadway:

> Dear Mr. Peterson:
>
> …We looked over the north portal of the Mary's Rock Tunnel, having at hand the topo [graphic map] taken by the Bureau [of Public Roads] and a model of the same scale which I had made in the office…. It was finally agreed that Mr. Austin would strip the overburden [all loose rock and soil above bedrock] back as far as he considered feasible, construct protecting cribbing [to protect the road below from rockslides], and obtain topography of this exposed [rock] ledge, on the basis of which we could collaborate the definite location of the wall. This, together with my version of the stonework would appear on a sheet to be submitted to you for recommendation and on to the Bureau for design….
>
> Very Truly Yours,
> Lynn M. Harris
> Jr. Landscape Architect
> Shenandoah National Park[7]

Harris and Austin reached agreement in the field, and the two stone retaining walls still in place on the north portal were installed.

But the problems with the tunnel were not over. The original design was too narrow for public use. Harvey Benson, Assistant Landscape Architect for Shenandoah National Park, wrote Peterson in December 1934 that the tunnel was "being widened [by four feet] to a width of twenty-seven feet…[to accommodate] a twenty-two foot roadway, a three foot pedestrian walk and built-in curb on the east side and a two foot curb and ditch on the west side [to deal with the water dripping into the tunnel from springs above]."[8] Benson also discussed, at length, plans to provide electric lighting for the interior of the tunnel, eventually discarded since newer cars came equipped with better electric headlights.[9]

Interior of Marys Rock Tunnel: This early interior view of the tunnel indicates the winter conditions before the concrete lining was installed in 1958-1959. Today, the north portal still exhibits icicles that, on occasion, can reach ten feet in length.

One final problem with the tunnel, and one that still remains to a lesser extent, was the constant seeping from springs uncovered during excavation. Although subsequent lining of the tunnel has partially corrected the problem, the north portal retains its spectacular icicles every winter.

Reed Engle is a Supervisory Landscape Architect.

[7] Harris to Peterson, July 12, 1934, SNPRMR, Box # 16, Folder 12

[8] SNPRMR. Box # 16, Folder 11

[9] Ibid. Many automobiles in use at the time Marys Rock Tunnel was constructed still did not have electric headlights or did not have interior switches for the lights. The first modern sealed beam headlight was invented in 1924, and the floor switch for headlights came into being in 1927. Sealed beam headlights were not legally required until the 1940s. Marys Rock Tunnel was constructed, and the lighting discussion occurred, in the transition period in which all new cars came equipped with electric headlights. Thus lighting the tunnel ultimately became unnecessary.

Shenandoah: An Abused Landscape?

By Reed Engle

Preface

Shenandoah National Park was authorized by Congress after a thorough and wide-ranging survey of various proposed locations by the Southern Appalachian National Park Committee, a group composed of park planners, arborists, and scientists. The group recommended the northern Blue Ridge Mountains, believing the area met National Park Service standards for new parks. Early scientific evaluation of the park's forest communities conducted by the Civilian Conservation Corps (CCC) echoed early publications that described the woodland wonders of Shenandoah. It was not until the 1960s that a new environmental history of the park began to be developed, one that characterized the pre-park natural history as one of wanton agricultural abuse, severe erosion, and the clear-cutting of the forest. Although many sections of the east, and many more agricultural areas of the south, did suffer such abuse, historical research in the past decade indicates that the exploitation of the Blue Ridge was primarily the responsibility of absentee landowners, and the park area was not a vast wasteland left for natural forces to reclaim.

The Context: Land Use in the East

Nineteenth century America was built on the extraction and use of its natural resources. As railroads spanned the continent, they demanded an endless supply of timber for ties and carried boxcar after boxcar of rough-sawn planks to build the new residences and western towns developed by the railroad companies. In a time before synthetics, leather was used for everything from footwear to the drive belts that transferred power from wood-powered steam engines. Leather was processed with tannic acid derived from bark, typically from chestnut oak (*Quercus montanus*), hemlock (*Tsuga canadensis*), white oak (*Quercus alba*), or chestnut (*Castanea dentata*). Borst's Tannery in Luray, a major supplier of Confederate leather goods, was burnt by the Union Army in 1863. It was followed by the Virginia Oak Tannery that continued to demand an endless supply of bark from adjacent woodlands.

Tanbark was stripped from trees in the early spring with a tool called a spud held by the young girl in this photograph taken in 1916 at the Ohio Agricultural Experiment Station. The bark was left to dry until it was taken to the tannery for leather production. As shown here in Ohio, and in Blue Ridge Mountains, chestnut oak (*Quercus prinus*) was the favored tree for bark. [1]

The Shenandoah Valley was a national center of iron production throughout the 19th century because it had, or was close to, abundant supplies of iron ore, limestone, and charcoal, the necessary ingredients for iron production. Iron provided the rails for the trains and the boilers for the steam engines, but required massive quantities of charcoal. Typically 1-6 acres of trees were required to produce the charcoal needed for a single day's output of an iron furnace, upwards of 1,700-1,800 acres per year/ per furnace.[2]

Within the proposed Shenandoah National Park one large tract, owned by John A. Alexander, typified the industrial and commercial exploitation of land in the eastern United States before and after the Civil War. Most of the property (19,554 acres) was located in Rockingham County, but small parts extended into Augusta, Greene, and Albemarle Counties. The State Commission on Conservation and Development survey of the property in 1927 stated:

> This tract was worked for iron ore at one time, but has not been operated for a great many years . . . . The more accessible parts of this tract were cut over many years ago, 1865 to 1879, to provide charcoal for an iron furnace located on Madison Run. On this portion of the tract practically no timber was left. About 1900 the chestnut oak timber was cut for bark. Since the bulk of the stand was comprised of chestnut oak, the bark operation removed the greater part of the remaining timber. Small portable mills have operated periodically over the tract for many years removing any timber which could be reached without too great difficulty . . . . Repeated incendiary fires have run over the tract destroying the reproduction, and injuring the immature and the old timber remaining. In many places, even the soil itself has been burned with the result that extensive portions have been rendered non-productive, and almost worthless.[3]

The entire tract (21,103 acres) was appraised at $35,605.50, an average value per acre of $1.69, as part of the Virginia condemnation for park lands.[4] In contrast, the most productive land in the future park area was appraised at $50.00/acre.

Although the Alexander tract is possibly the extreme, both in the east and certainly within Shenandoah

[1] Used by permission of the Ohio Agricultural Experiment Station, Department of Forestry, Digital Image Collection, photograph created June 1916.
[2] See www.indianacountyparks.org/parks/ef and <www.oldindustry.org/PA_HTML/PA_Hwell>
[3] Shenandoah National Park Archives, Resource Management Records, Land Records, Rockingham County, John. A. Alexander file.
[4] Alexander never received any profit for the land. He was in jail on a six-year sentence for fraud and embezzlement, having never paid the original owners for most of the land he "purchased" from them.

National Park, by the 1940s only between 0.1%-1.0% of the land east of the Mississippi River remained old-growth forest.[5] The great virgin forests of the east were a long-forgotten memory by the time Shenandoah National Park was established. They had been sacrificed for national expansion.

The Condition of the Land within Shenandoah National Park

Beginning in 1934, the Emergency Conservation Work (ECW) (CCC) program hired an Assistant Forester, R. B. Moore, to assess the condition of the proposed park area. Over the next several years, using the labor of CCC enrollees, Moore mapped the forest or vegetative cover on 172,828 acres of the proposed park. Dividing the land into watersheds, Moore defined 16 forest cover types[6] and five age classes.[7] Known forest fires were also mapped. The data were published on May 29, 1937 as "Forest Type Map Write-Up by Watersheds, Shenandoah National Park."

The broad status of the park lands was summarized in the "Acreages of Forest Types and Burns" (below). Moore showed that the mountains were not "stripped of cover," but in fact only 14.52% of the park acreage was open, either as cultivated or pasture land. Also of interest is that forest fires since 1930 had burned between 61.9% - 85.8% of the pine communities (which represented 17.71% of the forest cover) and 25.7% of the total park acreage.

In the detailed descriptions of the watersheds, Moore discussed the existing vegetative associations, soil types and conditions, reproduction of species, fire hazard potential, insect and fungal pests, and past history. Although he recognized that much of the park had been logged in the past, he identified eleven watersheds, or parts of watersheds, that retained significant forest communities with no evidence of previous logging activity: Hogwallow Flats, Hogback (south side), Beahms Gap (south and east sides), Pass Run to Shaver Hollow (upper slopes), the Robinson River watershed, Staunton River[8], Big Run, Loft Mountain (east side), Hangman Run, Devils Ditch and the Upper Conway River, and the lower slopes of Cedar Mountain. Although these areas indicated no evidence of former logging, many did show the effects of the wildfires that swept across the mountain in 1930, 1931, and 1932, possibly aggravated by the worst drought in Virginia history.

In his 179 page report, Moore listed only four instances of significant erosion: the northwest side of Neighbor Mountain/Jeremiah Run, the South Fork of the Thornton River, Pond Branch, and the North Branch, Moormans River. At the Neighbor Mountain/Jeremiah Run and Pond Branch locations, the forester stated that the "soils were burned to such an extent . . . . that little humus is left . . . . [and] the soil on these slopes is also thin and subject to erosion" and that "the soil on the higher ridges is practically gone showing evidence of past fire and erosion." In neither case was there evidence of logging, farming, or pasturing in the eroding areas. On the South Fork, Thornton River, Moore noted that there was "some evidence of erosion on the open fields [but that] . . . . this is being checked by the vegetation which is restocking the area." Only on the North Branch, Moormans River, did Moore state that the "large open pastured area has eroded badly . . . . and gullies three to four feet across have been cut into the mineral soil." It is photographs of this single area of the park that have come to characterize the "mismanagement of the land" and "poor farming practices" of the mountain people.[9]

Slightly fewer than 1,100 tracts of land were purchased to create Shenandoah National Park. Approximately 465 families lived within the park area, but only 207 of those families owned the land they lived on—in other words only 19.2% of the condemned tracts were owned by the "mountain people", acreage representing slightly less than 10% of the park area.[10] Only 348 of the 465

Cover Type	Total Acreage (% of Park Total)	Acreage Burned 1930-1937	Percent of Type 1930-1937
Cove Hardwood	8,333 (5.0%)	348	4.1
White Pine/Hardwood	828 (0.5%)	37	4.4
Oak/Hickory	4,020 (2.3%)	817	20.3
Mixed Oak	87,342 (50.5%)	15,689	17.9
Chestnut Oak	20,457 (11.8%)	8,575	41.2
Yellow Pine/Hardwoods	17,439 (10.1%)	11,153	63.3
Yellow Pine/Bear Oak	7,841 (4.5%)	6.730	85.8
White Oak	138 (0.08%)	None	0.0
Mixed Oak/Fraser Fir	64 (0.04%)	None	0.0
Black Birch	83 (0.04%)	None	0.0
White Pine	83 (0.04%)	None	0.0
Virginia Pine	844 (0.49%)	523	61.9
Open	25,089 (14.5%)	294	1.1
Barren	267 (0.15%)	239	89.0
TOTAL	**172,828**	**44,425**	**25.7**

[5] See Robert Leverett, *Old Growth Forests in the East*, at www.championtrees.org, Craig Romano, "Old Growth Forests of the East" at http://archives.thedaily.washington.edu/1996/071796/craig071796.html, and Whit Bronaugh, "In Search of Old-Growth Giants," *American Forests*, Spring (2000).

[6] Chestnut oak, red oak, red oak/"blue ridge fir", scarlet oak, pitch pine, white pine, bear oak, black locust, Virginia pine, cove hardwood, hemlock, grey birch, open land (restocking), open land (cultivated), open grassland, and barren (rock outcrops).

[7] All age, mixed age, 1-20 years, 21-40 years, and 41-60 years.

[8] Although Moore stated that there was no evidence of former logging in the Staunton River watershed, basing his field determination on the evidence of stumps, it is known that narrow gauge railroad track was laid up the watershed for logging. Perhaps the loggers took downed trees and/or dead chestnuts which would not have left significant evidence of removal.

[9] It is of great interest that both the Pond Ridge and Moormans River areas of the park were the most impacted park areas by the rains of Hurricane Fran in 1996. Gullies 8' deep were cut into the slopes above the North Branch.

[10] Compilation of the known and identifiable landowners remaining in the park in 1936 (104 owners out of 203) from R.A, records and cross-indexed with the park land records shows that the average owner had a 74.72 acre tract. This size multiplied by the total of original resident landowners would indicate that 15,467 acres of the park was originally owned by residents (8.95% of the park total).

families cultivated land, and the average family cultivated but 5.27 acres, a total farmed area of 2,450 acres (1.42% of the total land within the park).[11] The 22,369 remaining acres of "open land" inventoried by Moore represented pasture, orchard, and open space associated with resorts (Black Rock, Panorama, Skyland, and Swift Run). The overwhelming part of the pasture was deeded to absentee landowners who grazed their stock on the mountain slopes in the warmer months. A brief review of the Shenandoah National Park land records searching only for the obvious corporate or well-known Shenandoah Valley and Madison County landowners reveals that over 63,000 acres (37%) of the park was owned by only fourteen families and/or companies.[12] Even if the Blue Ridge Mountains had been the devastated area the developing myth of the 1960s suggested, and which Moore's work contradicted, it is in hindsight hard to see how the mountain residents could be held responsible for the actions of the absentee landowners and corporate interests that owned 90% of the future park.

Pollock photographed one of the most densely populated areas of the park from Old Rag in 1916. Although cleared pastures and orchards are evident, it is also clear that a majority of the mountaintops were densely forested.

Recent research, in fact, suggests that the small resident mountain farmers were probably more sensitive to the land than were the non-resident landowners:

> pockets of self-sufficient farms remained in places like the northern Blue Ridge Mountains of Virginia. These farmers, responsive to the constraints of the mountain landscape that surrounded them, tended to rely on less invasive, century-old technologies to work their fields. Although contemporaries widely disparaged this way of life, the records of these communities reflect a long history of viability and suggest that the ecological basis of upcountry agriculture was strong.[13]

A Changing Interpretation of Natural History

When the Southern Appalachian National Park Committee reviewed the questionnaires submitted by localities and individuals interested in obtaining the proposed national park for their area, the Blue Ridge Mountains proposal by Pollock, Allen, and Judd gushed with description of the untrammeled landscape. Because of the questionnaire, the Committee visited the area on several trips. The members were not novices to landscape, vegetation, or parks—they were selected because most had professional expertise. Although they recognized that the Great Smoky Mountains were more rugged and remote, they believed that the Blue Ridge Mountains met the criteria established for National Park status. Nowhere in their report to Congress is there an indication that the land was gutted with erosion gullies or the scars of significant extraction activities.

In 1937, Darwin Lambert clearly aware of Moore's CCC forest study, wrote:

> Seven-eighths of the Shenandoah National Park is covered by a green blanket of forest. This forest is composed of approximately eighty species of trees, at least that many more shrubs and vines, and almost countless kinds of smaller plants . . . . Throughout the entire area, in nearly all kinds of environments, the oaks are the most common. These oaks are of about ten different species. Chestnut oak is probably the most numerous, but there are many splendid white and red oak trees.[14]

Yet, four decades later the park's *Statement for Management* formalized a new view of the natural history of the park by noting that:

> before the mountains were stripped of cover, they were blanketed with a climax forest of mixed hardwoods with pockets of hemlock, balsam, and spruce . . . . Since the establishment of the Park, evidence of the settlement period has gradually faded from the scene, and most of the old homesites have become part of the deciduous forest.[15]

[11] "Summary Statement concerning Families in the Shenandoah National Park Area," Resource Management Records, Box 99 & Box 100

[12] These include Lariloba Mining Company, Madison Timber, Piedmont Copper Company, Eagle Hardwood Company, Alleghany Ore, Depford Company, Christadora Heirs, Fray & Green, Fray & Miller, J. D. & H. B. Fray, the Graves family, the Long family, John A. Alexander, and the Pollock family.

[13] Gregg, Sara M., "Uncovering the Subsistence Economy in the Twentieth-Century South: Blue Ridge Mountain Farms," *Agricultural History*, Vol. 78, Issue 4, pp. 417-437.

[14] *Beautiful Shenandoah: A Handbook for Visitors to Shenandoah National Park* (1937), p. 3.

[15] *Shenandoah National Park Statement for Management* (March 8, 1976), p. 8.

Soon this viewpoint would become standardized and accepted park history by researchers:

> Early in the nation's history, the mountains which now form the park were explored and hosted hunting and resource extraction activities; later, they began to serve as a refuge for the poor and landless, who became mountain people. Throughout this period, a body of folklore, legend, and archaeological materials accumulated while the land suffered increased use and degradation. Overgrazed and nearly lumbered out, the region was further affected economically in the early 1930's by the chestnut blight, which destroyed its last viable cash resource. In recognition of the plight of the area's residents and the need for lands to be preserved in their natural state near one of the nation's largest population centers, Shenandoah National Park was authorized in 1926 . . . .[16]

It was accepted that "over a century of heavy abuse had decimated the forests and wildlife and gullied the soils."[17] The problem with this view of pre-park Shenandoah, however, is that it neither placed the Blue Ridge Mountains within the context of the natural history of the Nation east of the Mississippi, nor fairly and factually represented the condition of the land within the park. The publication of Pollock's highly self-serving and inaccurate *Skyland,* and the republication of the now-discredited *Hollow Folk* in the late 1960s, codified the distorted lives of the mountain residents that National Park Service staff came to accept as factual. Few publications noted the extent and impact of the absentee landowners on the land within the future park, and fewer still discussed the massive erosion and impacts on natural resources caused by the construction of the Skyline Drive.[18]

The Blue Ridge Mountains were not virgin old-growth forest at the time of park establishment; but there were many areas that had not been logged or burned for many decades and some areas that approached old-growth status. Although a few areas demonstrated agriculturally caused erosion, far more erosion would come as a result of the construction of the Skyline Drive. Most recent research suggests that Shenandoah National Park was established after a careful selection process because its landscape had not been plundered as the literature of the 1960s suggested. Nature was able to so quickly "reclaim" the land because the land had not been truly lost.

Reed Engle is a Supervisory Landscape Architect.

[16] Ebert, James I. and Alberto A. Gutierrez, "Relationships Between Landscape and Archaeological Sites in Shenandoah National Park: A Remote Sensing Approach," *Bulletin of the Association for Preservation Technology*, Vol. XI, No 4, 1979, p.70.

[17] Conners, John A., *Shenandoah National Park: An Interpretive Guide*, Blacksburg, Virginia (1988), p. 90.

[18] Some of the most famous photographs historically used to demonstrate the erosion caused by previous "poor farming practices" in the Blue Ridge are, in fact, showing scenes downslope from the then recently -completed construction of the Skyline Drive.

Message from Russian Intern Kirill Kashin

By Kirill Kashin

Summer 2005 was probably the best in my life. I was invited to take part in the U.S. government student exchange program and work in the Mid-Atlantic Exotic Plant Management Team as an intern. When I came to Shenandoah NP, I was totally amazed at the beauty of its nature. The national park is situated in the Appalachians along the crest of the Blue Ridge Mountains in northern Virginia. There are so many picturesque overlooks along Skyline Drive and the mountains are covered with broad-leaved trees.

I worked in a crew of five people and I was the only foreign intern. The great advantage for me was that the crew I worked with had a trip to one of a dozen nearest parks in Virginia, Pennsylvania, and Maryland almost every week. So I wasn't stuck at one place but I traveled to many interesting parks such as Gettysburg National Battlefield or Washington Birth Place, and many others. My general tasks included monitoring nonnative vegetation within the traveling team. I conducted its controlling, including uprooting, cutting, and application of herbicides upon targeted plants, entered field data into a database, and worked with GPS and GIS. I had a great experience in working in a team with very nice people whose help I greatly appreciate!

Kirill Kashin among members of the NPS Mid-Atlantic Exotic Plant Management Team, 2005.

At Shenandoah I was lodged in government housing. I shared my house with two American volunteers who turned out to be very nice guys. I made many friends at Shenandoah. We had a chance to go to many interesting places in the U.S., including Washington D.C, New York City, Niagara Falls, etc. They helped me to get their culture, play American sports and, of course, improve my English.

Every day was full of different interesting events and new doings. Therefore, I greatly appreciate the help of those who supervise this program in Moscow, Russia, and in Virginia, USA, especially James Åkerson, Supervisory Forest Ecologist (Shenandoah NP, USA), Dr. Svetlana Maiorshina , Associate Professor of English (MFPU, Russia), and Dr. Victor Dronov, Professor of Geography, Dean (MFPU, Russia). I do hope my American experience will help me a lot in my career and my grown-up life.

Kirill Kashin
5th-year student of the Geography Department,
Moscow Federal Pedagogical University

The purpose of the Shenandoah National Park Resource Management Newsletter is to convey information on Shenandoah's natural, cultural, and backcountry/wilderness resources, issues, and programs to park employees and the interested lay public. We will strive to present a mix of current activities, research and monitoring findings, and basic information about the park's resources in an informal publication on a annual basis. We welcome short articles meeting this purpose from both park staff and cooperators. Paper copies of the newsletter will be distributed to park employees and others upon request, and will be distributed with permission by the Shenandoah National Park Association to its members.

Editor
Debbie Sanders

Chief of Natural & Cultural Resources
Gary Somers

Comments? Write to:
Superintendent
Shenandoah National Park
3655 Highway 211 East
Luray, VA 22835

Editor's Note:

It is with mixed emotions that I write this note of my departure. I have been offered a promotion and have accepted a position with the Federal Emergency Management Agency. I would like to express my sincere appreciation to Shenandoah National Park as well as the many friends and colleagues I have worked with through the years. I wish Shenandoah National Park continued success and want to thank you for allowing me to be part of this great organization.

Farewell,
Debbie Sanders

National Park Service
U.S. Department of the Interior

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